77-FM-2
Rev. 5

JSC-12561
AUG 1 1 1980

Orbiter Electrical Equipment Utilization Baseline

Mission Planning and Analysis Division

August 1980

National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

77-FM-2
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JSC-12561

SHUTTLE PROGRAM

ORBITAL ELECTRICAL EQUIPMENT UTILIZATION BASELINE

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Kenneth A. Young, Chief
Flight Planning Branch

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Mission Planning and Analysis Division

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National Aeronautics and Space Administration

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Houston, Texas

August 1980

CONTENTS

TABLES

FIGURES

SYMBOLS

A	Aft
AC	Alternating Current
ADI	Attitude Director Indicator
ADTA	Air Data Transducer Assembly
AMI	Alpha/Mach Indicator
APU	Auxiliary Power Unit
ARS	Atmospheric Revitalization System
ASA	Aerosurface Servo Amplifiers
ATC	Air Traffic Control
ATCS	Active Thermal Control System/Subsystem
ATVC	Ascent Thrust Vector Control
AVVI	Altitude/Vertical Velocity Indicator
BF	Body Flap
BITE	Built-In Test Equipment
B&W	Black and White
CAS	Consumables Analysis Section
CF	Center Forward
CL	Center Line
COAS	Crew Optical Alinement Sight
CONUS	Continental United States
CPU	Central Processing Unit
CRT	Cathode-Ray Tube
CTPD	Crew Training and Procedures Division
C&W	Caution and Warning
DA	Deploy Assembly
DC	Direct Current
DDU	Display Driver Unit
DEU	Display Electronics Unit
DFI	Development Flight Instrumentation
DOD	Department of Defense
DP	Deorbit Preparations
DPS	Data Processing System/Subsystem
DSC	Dedicated Signal Conditioner
DU	Display Unit
ECLSS	Environmental Control and Life Support System
ECN	EEL Change Notification
EEL	Electrical Equipment List
EI	Entry Interface (400 000 ft)
EMU	Extravehicular Mobility Unit
EOM	End of Mission
EPDS	Electrical Power Distribution System/Subsystem
EPS	Electrical Power System/Subsystem
ET	External Tank
EVA	Extravehicular Activity
EVLSS	Extra Vehicular Life Support System
F	Fahrenheit, Forward
FA	Flight Aft (MDM)
FC	Fuel Cell
FCD	Flight Control Division
FCP	Fuel Cell Powerplant

FCS	Flight Control System, Flight Control Surface
FDM	Frequency Division Multiplexer
FDV	Feed Valve
FES	Flash Evaporator System
FF	Flight Forward (MDM)
FM	Frequency Modulation
FOD	Flight Operations Directorate
FPS	Feet per Second
F&D	Fill and Drain
GET	Ground Elapsed Time
GH2	Gaseous Hydrogen
GMT	Greenwich Mean Time
GNC	Guidance, Navigation, and Control
GN2	Gaseous Nitrogen
GO2	Gaseous Oxygen
GPC	General Purpose Computer
GSE	Ground Support Equipment
HSI	Horizontal Situation Indicator
HX	Heat Exchanger
H2	Hydrogen
H2O	Water
ID	Identification
IECM	Induced Environmental Contamination Monitor
IMU	Inertial Measurement Unit
IOP	Input/Output Processor
IPL	Initial Program Load
IPS	Inches per Second
IRIG	Inter Range Instrumentation Group
IVD	Isolation Valve Driver
JSC	Johnson Space Center
KBPS	Kilobits per Second
L	Left
LA	Launch AFT (MDM)
LCA	Load Controller Assembly
LCG	Liquid-Cooled Garment
LF	Launch Forward (MDM), Left Forward
LG	Landing Gear
LH	Left Hand
LH2	Liquid Hydrogen
LI	Left Inboard
LO	Left Outboard
LOX	Liquid Oxygen
LO2	Liquid Oxygen
LP	Left Pod (OMS)
LPS	Launch Processor System
L/O	Lift-Off
M	Mid
MARS	Modular Airborne Recording System
MCA	Motor Control Assembly
MCIU	Manipulator Control Interface Unit
MDM	Multiplexer/Demultiplexer

MEC	Master Event Controller
MECO	Main Engine Cutoff
MET	Mission Elapsed Time
MHZ	Megahertz
MPAD	Mission Planning and Analysis Division
MPS	Main Propulsion System
MS	Mission Station
MSBLS	Microwave Scan Beam Landing System
MSFC	Marshall Space Flight Center
MSS	Mission Specialist Station
MTU	Master Timing Unit
NASA	National Aeronautics and Space Administration
NCC	Corrective Combination Maneuver
NG	Nose Gear
NH3	Ammonia
NLG	Nose Landing Gear
NSP	Network Signal Processor
N2	Nitrogen
N/A	Not applicable
OAI	Operational Aft Instrumentation
OC	Orbital Configuration
OFI	Operational Flight Instrumentation
OFT	Orbital Flight Test
OI	Operational Instrumentation
OMS	Orbital Maneuvering System/Subsystem
OOS	On Orbit Station
OPS	Operational Missions
OV	Orbiter Vehicle
O2	Oxygen
PA	Power Amplifier
PBD	Payload Bay Doors
PBK	Payload Bay Kit (OMS)
PCA	Power Controller Assembly
PCG	Power Control Group
PCM	Pulse Code Modulation
PCMMU	Pulse Code Modulation Master Unit
PCR	Power Change Request
PDI	Payload Data Interleaver
PDU	Power Drive Unit
PF	Payload Forward (MDM)
PIC	Pyro Initiator Controller
PL	Payload
PLB	Payload Bay
PLD	Payload
PLSS	Portable Life Support System
PM	Phase Modulation
PS	Power Supply, Payload Station
PSIA	Pounds per Square Inch Absolute
PSS	Payload Specialist Station
P/L	Payload
R	Right
RCS	Reaction Control System/Subsystem

RF	Radio Frequency, Right Forward
RFI	Radio Frequency Interference
RGA	Rate Gyro Assembly
RH	Right Hand
RHC	Rotation Hand Controller
RI	Right Inboard, Rockwell International
RJDF	Reaction Jet Driver Forward
RJDA	Reaction Jet Driver Aft
RMS	Remote Manipulator System
RO	Right Outboard
RP	Right Pod (OMS)
RPC	Remote Power Controller
RPTA	Rudder Pedal Transducer Assembly
RTLS	Return to Launch Site
SBTC	Speed Brake/Thrust Controller
SCU	Signal Conditioning Unit
SD	Smoke Detection
SGLS	Space-Ground Link Subsystem
SGSC	Strain Gage Signal Conditioner
SILTS	Shuttle Infrared Leeside Temperature Sensing
SL	Spacelab
SOURCE	Shuttle Orbiter Unified Records for Consumables Evaluation
SPI	Surface Position Indicator
SR	Stoproll
SRB	Solid Rocket Booster
SSME	Space Shuttle Main Engine
STDN	Spacecraft Tracking and Data Network
S/C	Signal Conditioner
S/O	Shutoff
S/S	Subsystem
TACAN	Tactical Air Navigation
TBD	To Be Determined
TC	Thermal Control
TCS	Thermal Control System
TD	Touchdown
TDRS	Tracking and Data Relay Satellite
THC	Translation Hand Controller
TM	Telemetry
TV	Television
TVC	Thrust Vector Control
UCR	Utilization Change Request
UHF	Ultra High Frequency
V	Valve
VDC	Volts Direct Current
W	Watts
WBM	Wideband Mission
WBSC	Wideband Signal Conditioner

1.0 SUMMARY

This document establishes the baseline for utilization of Orbiter electrical equipment in both electrical and Environmental Control and Life Support System (ECLSS) thermal analyses. It is a composite catalogue of Space Shuttle equipment, as defined in the Shuttle Operational Data Book for OV-102 and subs (ref. 1). The catalogue describes the major functions and expected usage of each component type. It then delineates the specific usage of electrical components within analyses performed at JSC. The catalogue specifically addresses STS flights 1 and 2, OFT and operational flights in general.

2.0 INTRODUCTION

The effective use of data derived from orbiter electrical and ECLSS thermal analyses depends to a great extent on proper definition of electrical equipment utilization and coordination of the various agencies performing analyses. All individuals and groups concerned with the formulation, performance, verification, and interpretation of analyses must have a common understanding of equipment usage. Furthermore, to be most effective, this common understanding must be recognized as the baseline for all analyses, and any deviations from this baseline must be fully identified.

The purpose of this document is to establish the common baseline for coordinating and controlling orbiter electrical and ECLSS thermal analyses. The document describes the major functions and planned, or expected, usage of each type of Orbiter electrical equipment and prescribes the specific usage of that equipment in Orbiter electrical and ECLSS thermal analyses.

The functional descriptions are designed to provide a fundamental understanding of the Orbiter electrical equipment. They are intended to insure correlation of equipment usage within nominal analyses and to aid analysts in the formulation of off-nominal, contingency analyses. The generic usage definitions provide a means of tracking equipment utilization changes and of verifying proper usage of electrical equipment within nominal Orbiter analyses. The analysis usage statements serve to coordinate analyses and to assist users in the validation and interpretation of data. In addition, these statements precisely define and control the use of Orbiter electrical equipment within the Shuttle Orbiter Unified Records for Consumables Evaluation (SOURCE) data base (ref. 2).

Figure 2.1 illustrates the manner in which this baseline and the SOURCE data base are used to coordinate and control the various Orbiter electrical and ECLSS thermal analyses. It can be seen, from the figure, that the baseline combines an Orbiter Electrical Equipment List (EEL) with various utilization documents to define the specific usage of orbiter electrical equipment for purposes of analyses. These definitions specify and control the content of the SOURCE data base, and are used, apart from the SOURCE data base, in the formulation of off-nominal analyses and as a means of coordinating analyses with other agencies. The SOURCE data base is used in combination with specific flight data to perform nominal electrical and ECLSS thermal analyses at the Johnson Space Center.

The equipment list, contained herein, is based on the Orbiter EEL's of reference 1, as modified by Power Change Requests (PCR's) and EEL Change Notifications (ECN's). The corresponding functional and utilization data are in accordance with information derived through a series of subsystem review meetings, as modified by crew procedures, mission rules, simulation data, and approved Utilization Change Requests (UCR's).

Approved changes will be incorporated into this baseline by means of Change Sheets and Revisions. Change sheets will be used to maintain a cohesive document through periodic page additions, deletions, and replacements. Major document revisions will be published when required. In addition, Change Notices will be used to rapidly disseminate approved utilization changes. Cognizant personnel may initiate changes to this document in accordance with the requirements of Section 5.0.

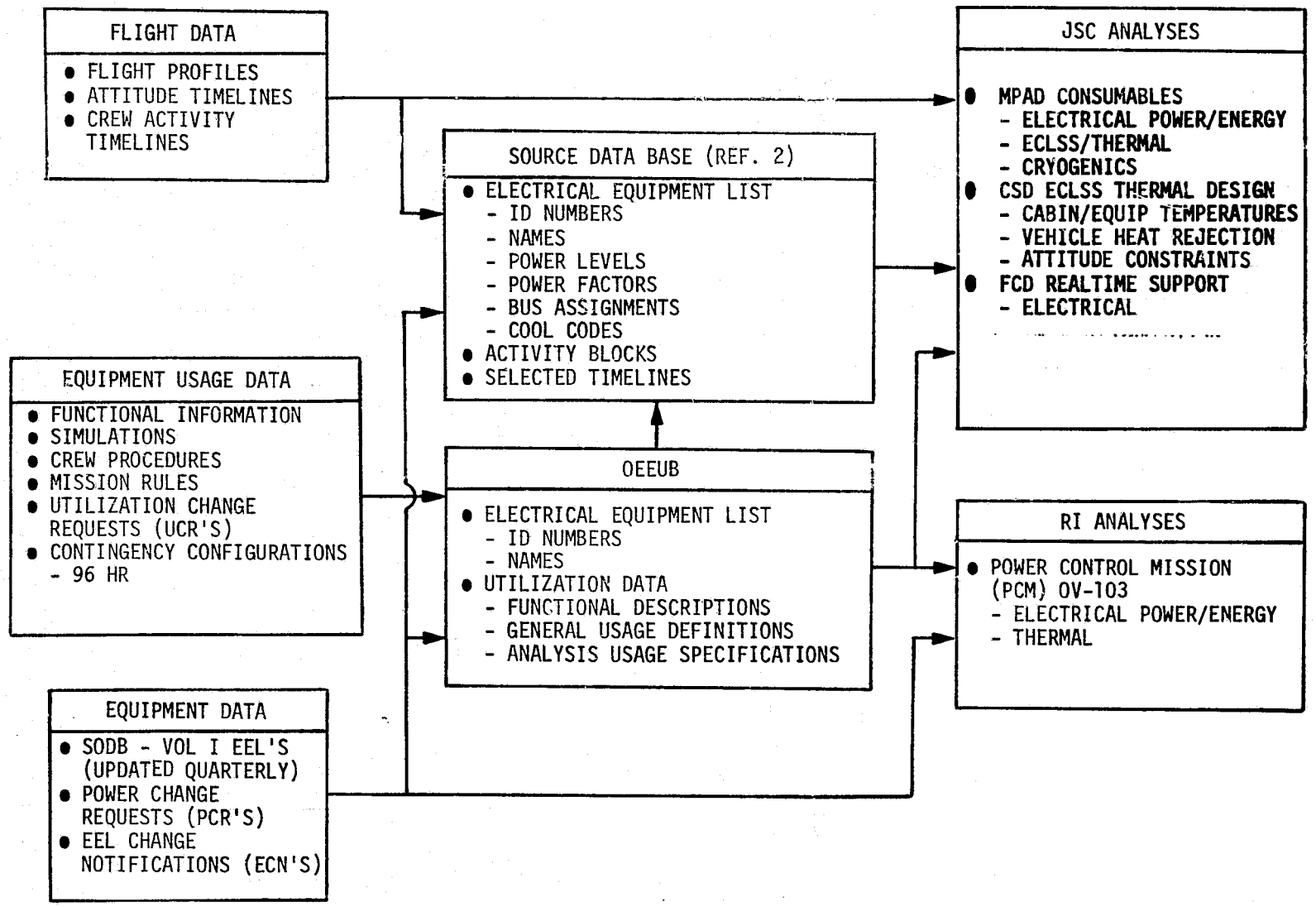

Figure 2.1 - Electrical and ECLSS thermal analysis coordination and control.

3.0 ORBITER ELECTRICAL EQUIPMENT UTILIZATION BASELINE

Electrical power and electrical energy analyses require the application of electrical loads to an electrical power distribution system (EPDS). The EPDS may be the actual system, a breadboard, or a computer simulation (math model). In a similar manner, the loads may be the actual electrical components or some representation of those components. In any event, the validity of the analyses depends to a great extent upon the accuracy with which the expected, or planned, usage of electrical components is simulated, as well as upon the fidelity of that equipment and the EPDS, or their simulations. This is particularly true when similar analyses are performed using differing computer simulations.

Shuttle Orbiter electrical analyses are performed by a number of agencies, both contractor and NASA. These analyses have diverse purposes, each of which establishes its own unique requirements with regard to simulation fidelity and data output. Some analyses evaluate the Orbiter EPS and EPDS designs. Others provide a means of controlling and tracking Orbiter energy growth, evaluating proposed mission profiles, and assessing the ability of the Orbiter to operate under various contingency situations. In addition, some electrical analyses create heat tapes for use in tracking Orbiter heat load growth, determining cabin and equipment temperatures, and defining orbiter heat rejection requirements. If these varied analyses are to be most effective, they must be coordinated and controlled so as to provide a common basis for the comparison of results.

The Orbiter Electrical Equipment Utilization Baseline provides the means of coordinating the usage of electrical equipment within analyses, and facilitates their control. Control of electrical and ECLSS thermal analyses, performed JSC, is implemented by means of the SOURCE Data Base, which is a mechanized adjunct to this baseline (ref. 2). The utilization baseline is a catalogue of functional descriptions and usage information. It consists of a comprehensive electrical equipment list (EEL); data describing the major FUNCTION and planned, or expected, nominal USAGE of each component type; and the specific ANALYSIS USAGE of each component. The baseline is presented in Appendices A and B.

3.1 UTILIZATION BASELINE ELECTRICAL EQUIPMENT LIST

The baseline EEL, contained herein, is a composite of the major electrical equipment installed on OV-102 and subs. The list consists of a numerical tabulation of components, both by type and by item. Its format and content were selected so as to present the data in a meaningful manner, while minimizing duplication and facilitating its incorporation into the SOURCE Data Base. Effectivities are provided to delineate specific equipment installations. These effectivities are defined in Appendix A. Their use, in conjunction with the SOURCE Data Base, permits analyses to be performed readily, using the equipment complement of any desired Orbiter.

The equipment list, contained herein, is the composite of those presented in the Shuttle Operational Data Book (ref. 1) for OV-102 and subs, as modified by PCR's and ECN's.

3.2 FUNCTIONAL DESCRIPTIONS

Functional descriptions are presented in Appendix A for each generic component type. These descriptions were designed to serve as a guide to the usage of electrical equipment in the formulation of both nominal, and off-nominal, electrical analyses, and to simplify the correlation of analysis results with planned mission activities. The descriptions are broad in scope and general in nature, and address only the major function, or functions, of the equipment. Supplemental information is provided, where necessary, to aid in the interpretation of the descriptions and to insure proper use of equipment within analyses derived therefrom.

The functional descriptions, contained herein, are in accordance with information derived through a series of subsystem review meetings (ref. 3), as modified by approved UCR's.

3.3 USAGE INFORMATION

Usage definitions are presented in Appendix A for each generic component type. These definitions delineate the planned, or expected, nominal usage of Orbiter electrical equipment, as it pertains to electrical power and energy analyses. The definitions were developed to:

a. Insure proper usage of electrical equipment in the performance of Orbiter electrical power and energy analyses

b. Coordinate nominal equipment usage for purposes of electrical power and energy analyses

c. Provide a means of correlating the results of otherwise unrelated electrical and/or ECLSS thermal analyses

d. Provide visibility with regard to the electrical and ECLSS thermal effects of proposed design and/or equipment utilization changes

e. Serve as the baseline data set for the development of the SOURCE Data Base

f. Facilitate direct correlation of analysis results with planned mission activities

g. Simplify and expedite the formulation of electrical power and energy analyses

h. Enhance the value of the various electrical and ECLSS thermal analyses, through standardization

The usage of electrical equipment, as stated herein, is intended to reflect, as nearly as possible, the planned, or anticipated, nominal usage of Orbiter electrical equipment. The data are provided for use in the formulation of electrical analyses, and, therefore, addresses the equipment from that stand point. No

attempt has been made to detail the usage of equipment, but only to define when it can reasonably be expected to be energized.

The usage definitions, contained herein, are in accordance with information derived through a series of subsystem review meetings (ref. 3), as modified by crew procedures, mission rules, and approved UCR's.

3.4 ANALYSIS USAGE INFORMATION

The use notes described in Section 3.3 define the number of units which are energized at various times throughout a nominal flight. In most cases, however, they do not specify the particular unit, or units to be energized. Indeed, with reusable Orbiters, the operational configuration can be expected to vary widely from flight-to-flight, making it unrealistic to define a single flight configuration. In order to perform a nominal electrical analysis, of any kind, it is, therefore, necessary to select an active set of electrical equipment which satisfies the, more or less general, usage as defined in Section 3.3. In addition, to perform off-nominal analyses the usage of Orbiter equipment must be deduced from the functional descriptions of Section 3.2, for application to the particular contingency under consideration.

3.4.1 Nominal Analysis Usage

For purposes of this baseline, nominal analyses are considered to fall into two general categories: Orbital Flight Test (OFT) and Operational (OPS). OFT analysis usage at present is defined for only the first orbital flight test unless the item(s) are known to be used on OFT flights in general; e.g., DFI components. Operational usage is defined for all subsequent flights of sufficient duration to require and/or permit an on-orbit system reconfiguration.

The specific usage of electrical components, within JSC electrical analyses, is described in Appendices A and B. Appendix B addresses the analysis usage of heaters and those items of equipment which vary primarily as a function of attitude and beta angle. Appendix A addresses all other equipment. The OFT and OPS analysis usage, as stated in these appendices, precisely define the usage of electrical equipment within analyses performed using the SOURCE Data Base (ref. 2).

4.0 LIMITATIONS AND CONSTRAINTS

The Orbiter electrical equipment utilization baseline has been developed primarily as an aid in the formulation, interpretation, and coordination of electrical and ECLSS thermal analyses. The baseline reflects, rather than specifies, the usage of Orbiter electrical equipment. In its formulation, it was necessary to make various assumptions, and these impose certain limitations on the utilization of the baseline and the interpretation of data derived therefrom. Some of the more important considerations are enumerated below.

a. The designs of the subsystems, addressed herein, have not yet been finalized. The FUNCTION and USAGE information represent current best estimates.

b. The equipment effectivities, contained herein, have been determined from available information and are intended only for purposes of analysis.

c. Equipment USAGE, as stated herein, is directed primarily toward when equipment is energized, rather than to how it is used when it is energized.

d. In general, nominal ANALYSIS USAGE, as stated herein, pertains to extended duration orbital flights (nominally greater than 24 hours).

e. The nominal ANALYSIS USAGE, as described herein, represents the operation of electrical equipment within analyses performed using the SOURCE Data Base. The stated usage is valid for all analyses in which the timelines are constructed so as to utilize the SOURCE Data Base activity blocks in accordance with the requirements of Table 4.2.-1 of reference 2.

f. The usage of certain components is functionally related to events which occur at relatively low altitudes (i.e. ET Jettison, 200 Knots, Final Approach, etc). The timing of these events varies from flight to flight, yet has a minimal effect on the results of analyses. The ANALYSIS USAGE of the affected components has been standardized in relation to major events, such as lift-off, MECO, Entry Interface, and Touchdown.

g. In the absence of explicit data, equipment known to change status in going from ascent to on-orbit was assumed to change state halfway through a one hour orbital configuration period commencing immediately after OMS-2. In a similar manner, equipment known to change status in going from on-orbit to descent was assumed to change state halfway through a deorbit prep period commencing three hours prior to deorbit.

h. In the absence of explicit information, no attempt was made to balance heat loads through the selection of active electrical components.

5.0 EQUIPMENT UTILIZATION BASELINE CONTROL PROCESS

The objective of the Equipment Utilization Baseline Control Process is to provide an orderly continuum of authoritative information regarding Orbiter subsystems and flight operations, as they pertain to electrical and ECLSS thermal analyses. The process consists of a proposal-approval-revision cycle, operating under the cognizance and control of the Level III Orbiter Power Control Group (ref. 4).

5.1 ORBITER POWER CONTROL GROUP

The Orbiter Power Control Group (PCG) reviews those change requests which affect Orbiter power requirements and recommends alternate action as appropriate to the Level III Change Control Board. The PCG processes changes affecting both hardware (design changes) and hardware utilization (operational changes). This document deals primarily with operational changes, being concerned with design changes only to the extent that they affect the utilization of electrical equipment.

Design Changes are processed by means of the Power Change Request/Impact Assessment form, in accordance with the requirements of reference 4. These changes only indirectly affect this baseline. Operational Changes are processed using the Orbiter Electrical Equipment Utilization Baseline Change Request form of figure 5.1.

5.2 EQUIPMENT UTILIZATION BASELINE CHANGE REQUESTS

Changes to the equipment utilization baseline may be requested by any responsible individual or group, either contractor or NASA. To do so, it is necessary to submit a completed change request form (ref. fig. 5.1) to FM2, Consumables Analysis Section, attention S. O. Mayfield. These forms should be completed in accordance with the guidelines outlined below.

a. Where practical, proposed changes should be made by marking up or revising a copy of the latest baseline revision, and submitting the changed pages with the completed change request form cover sheet. If the incorporation of a proposed change results in extensive, or confusing, markups of existing pages, sections should be reworked in their entirety such that the proposed change is specific and clear.

b. Changes should not be grouped into large packages. Only related changes should be grouped together, and then only when all aspects of the proposal can be approved, or disapproved, as a single entity.

c. Changes should be complete, clear, and, where possible, self-explanatory.

d. To facilitate approval, changes should be coordinated with all affected organizations prior to submission. In addition, where changes are predicated on released documentation, those documents should be referenced by name, number, and date.

Changes, accepted by FM2, will be incorporated into the Orbiter Electrical Equipment Utilization Baseline for use in electrical and ECLSS thermal analyses. A copy of all disapproved change requests will be returned to the originator, along with the reason for rejection.

5.3 EQUIPMENT UTILIZATION BASELINE MAINTENANCE

The responsibility for maintenance of this baseline document is vested with the Consumables Analysis Section of the Mission Planning and Analysis Division. The Consumables Analysis Section shall discharge this responsibility by means of Change Notices, Change Sheets, and Revisions.

5.3.1 Change Notices

Change Notices shall be used as an expedient means of rapidly disseminating information, for the purpose of maintaining a current data set. Upon acceptance of a Utilization Change Request (UCR) for incorporation into the baseline, the Consumable Analysis Section will interpret the data and prepare a Utilization Change Notice (UCN, ref. fig. 5.2) which will describe in detail the change to be implemented in the data base. The UCN will be routed to the cognizant individuals, and when requested, to document holders of record. These changes will appear in the next update cycle to this document and to the SOURCE Data Base. To request distribution of Change Notices, contact MPAD Consumables Analysis Section, FM2.

5.3.2 Change Sheets

Change Sheets will be used to periodically incorporate approved changes into the baseline document. These changes will be made as page-by-page additions, deletions, or replacements. They will be transmitted to all document holders of record, with all necessary instructions for their incorporation into the document.

5.3.3 Revisions

Document Revisions will be published when sufficient changes have been processed to warrant such action. These revisions will carry revision numbers and dates, and will be transmitted to all document holders of record.

UCR NO._____ PCR NO._____ INITIATOR_____ PH/MAIL_____	ORBITER ELECTRICAL EQUIPMENT UTILIZATION CHANGE NOTICE -UCN-	CHG NO._____ SHT_____OF_____ DATE_____ LOG NO._____

OEEUB Rev._____Chg._____Table No._____Comp ID No._____

The Orbiter Electrical Equipment Utilization Baseline is revised as stated below. This revision will be incorporated in change _____ to the Source Data Base. Comments regarding this change should be directed to _____ Phone_____.

DESCRIPTION OF CHANGE:_____

RATIONALE:_____

ROUTING:

MDTSCO-HAD____	FOD_____	E&D_____	MPAD_____
_____	_____	_____	_____
_____	_____	RI_____	OTHER_____
OPO_____	_____	CTPD_____	_____

Change incorporated by_____ Date_____

Page 1 of 2

Figure 5.1 - Equipment utilization baseline change request form.

ORBITER ELECTRICAL EQUIPMENT UTILIZATION
CHANGE NOTICE

TABLE A-

UCN NO._____

SHT_____OF_____

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Page 2 of 2

Figure 5.1 - Concluded.

INIT. NO.	ORBITER ELECTRICAL EQUIPMENT UTILIZATION UTILIZATION CHANGE REQUEST	LOG NO.
DATE		LOG DATE

INITIATOR | PHONE | ORG.

OEEUB Rev._____ Chg._____ Table No._____ Comp. ID No._____

Recommended Change:

- ☐ The function should be revised as stated below
- ☐ The usage should be revised as stated below
- ☐ Other (Explain)_____

Disposition:

- ☐ Accepted
- ☐ Rejected - See reverse side
- ☐ Deferred - See reverse side

APPLICABLE TO:

☐ All OFT	☐ OV103	☐ OV104	☐ OV102(M)	☐ 099	☐ Specific Mission _____
☐ All OPS	☐ STS-1	☐ STS-2	☐ STS-3	☐ STS-4	☐ 96 hr

DESCRIPTION OF CHANGE:_____

RATIONALE:_____

COORDINATE WITH:

_____S/S Mgr.	_____FCD	_____MPAD
_____CTPD	_____ASTRO. OFF.	_____MSFC
_____RI	_____MDTSCO	_____OTHER

Page 1 of 2

Figure 5.2 - Equipment utilization change notice form.

UCR DISPOSITION RECORD

DISPOSITION	REASON	ACTION REQUIRED
☐ Accepted	☐ Previously incorporated	☐ Coordinate usage
☐ Rejected	☐ Data superseded	☐ Revise and resubmit
☐ Deferred	☐ Inadequate explanation	☐ Other_____
	☐ Conflicting usage	_____
	☐ Other_____	_____

Note: Deferred UCR's will not be incorporated unless resubmitted.

Remarks: _____

Comments regarding the disposition of this UCR should be directed to _____ Phone _____.

Page 2 of 2

Figure 5.2 - Concluded.

REFERENCES

1. Operational Data Branch: Shuttle Operational Data Book, Volume I - Shuttle Systems Performance and Constraints Data. JSC-08934 (Vol I), October 1977 and Amendments.

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3. MA/Manager, Orbiter Project: Review of Electrical Power System Data Base for Consumables Analyses, Vol. 2, Electrical Equipment Utilization. Memo No. WA-75-251, June 1975.

4. ME/Manager, Orbiter Engineering Office: Operation of the Orbiter Power Control Group. Memo No. WA4-75-227, March 1975.

5. RI: 1978 FTR Baseline OFT Mission Planning Thermal Analysis. Memo No. SEH-ITA-78-255, December 1978.

6. RI: Nominal STS-1 Heater Duty Cycles. (On Orbit) Memo No. SEH-ITA-79-197.

7. ES/Chief, Structures and Mechanics Division: On-Orbit Orbiter Heater Power Consumables Evaluation Results for Preliminary Mission Planning. Memo No. ES34-1/76-09M, January 1976.

8. RI: Documentation of Orbiter Fwd Fuselage On-Orbit Temperature/Heater Power Consumables Results. Memo No. SEH-ITA-75-353, December 1975.

9. RI: Documentation of Orbiter Mid Fuselage Heater Power Consumables Evaluation and On-Orbit Temperature Summary. Memo No. SEH-ITA-75-347, December 1975.

10. RI: Documentation of Orbiter Aft Fuselage On-Orbit Temperature/Heater Power Consumables Results. Memo No. SEH-ITA-75-336, December 1975.

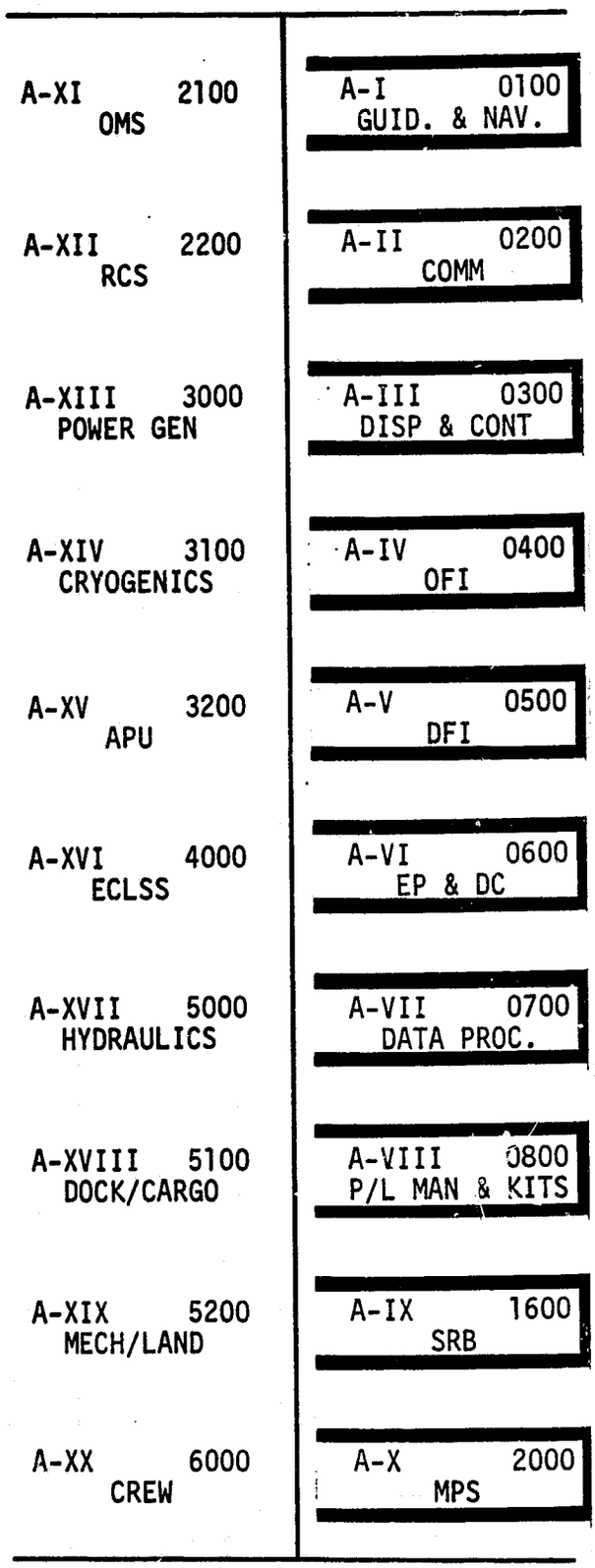
11. RI: Thermal Control Requirements for OMS Line Heaters. Memo No.SAS-TA-TCS-76-270, October 1976.

12. RI: Heater Power Requirements and Duty Cycles for Orbiter Heat Rejection Study (MCR 2154). Memo No. SAS-TA-TCS-75-347, October 1975.

13. RI: Documentation of the Mid Fuselage Heater Power Consumables SINDA Thermal Math Model (SMI100S). Memo No. SEH-ITA-75-324, December 1975.

14. RI: STS-1 Heater Duty Cycles (Prelaunch, Ascent and Descent) Memo No. SEH-ITA-80-050T, 10 March 1980.

15. Beech Aircraft: Memorandum Report MR16547, 11 October 1974.


A-XI 2100
OMS
A-XII 2200
RCS
A-XIII 3000
POWER GEN
A-XIV 3100
CRYOGENICS
A-XV 3200
APU
A-XVI 4000
ECLSS
A-XVII 5000
HYDRAULICS
A-XVIII 5100
DOCK/CARGO
A-XIX 5200
MECH/LAND
A-XX 6000
CREW
A-I 0100
GUID. & NAV.
A-II 0200
COMM
A-III 0300
DISP & CONT
A-IV 0400
OFI
A-V 0500
DFI
A-VI 0600
EP & DC
A-VII 0700
DATA PROC.
A-VIII 0800
P/L MAN & KITS
A-IX 1600
SRB
A-X 2000
MPS

APPENDIX A

ORBITER ELECTRICAL EQUIPMENT

UTILIZATION BASELINE

APPENDIX A

ORBITER ELECTRICAL EQUIPMENT

UTILIZATION BASELINE

The following guidelines should be used in interpreting the data contained within this appendix:

1. ID No/Equipment Description

   XXXXX (5 Digits) - Component Type

   XXXXXXXX (8 Digits) - A specific component or group of components

   (XX) (2 Digits) - Number of components included within a group if other than one

2. POWER (WATTS) - The power consumed by the component, in the specified mode, rounded to the nearest watt. This represents the power as reflected in the SODB. (ref. 1).

3. EFF (Effectivity)

   XXXX

   First Digit - Operational vehicles OV-101*, OV-102*, and OV-103:

   0 = None
   4,5,6,7 = OV-101
   2,3,6,7 = OV-102
   1,3,5,7 = OV-103
   8,9 = Undefined

   *Designates OV-101 and OV-102 converted to operational configurations

   Second Digit - Operational vehicles OV-104, OV-105, and OV-106:

   0 = None
   4,5,6,7 = OV-104
   2,3,6,7 = OV-105
   1,3,5,7 = OV-106
   8,9 = Undefined

   Third Digit - Orbital Flight Test vehicle STS-1, STS-2, STS-3:

   0 = None
   4,5,6,7 = STS-1
   2,3,6,7 = STS-2
   1,3,5,7 = STS-3
   8,9 = Undefined

Fourth Digit - Orbital Flight Test vehicle STS-4, STS-5, STS-6:

0 = None
4,5,6,7 = STS-4
2,3,6,7 = STS-5
1,3,5,7 = STS-6
8,9 = Undefined

NOTE: Effectivity as derived from available data for analysis usage only

4. Activity Blocks - SOURCE Data Base Activity Blocks to which components are assigned:

001 - FT1 151-1 PLB Latch Test
003 - FT1 151-2 PLBD Cycling Tst
005 - FT1 151-3 Rad Ltch/Dply Tst
007 - RMS Deploy Test
009 - RMS Latch Test
011 - RMS Arm Maneuver Test
051 - Post Deorbit Rehearsal Reconfig
055 - RMS Support

101 - Mission Common (GSE-GSE)
103 - Ascent Common (GSE-OMS2)
105 - Orbit Common 1 (Orb-Deorb)
107 - Orbit Common A (OC-DP)
109 - Descent Common (Deorb-GSE)
111 - Descent Common (Deorb-SR)
113 - Orbit Common 2 (Orb-Deorb)*
115 - Orbit Common B (OC-DP)*
117 - Development Flight Instrumentation
119 - Orbital Modes*
121 - Fuel Cell 3 On-Line
123 - Ascent Common (GSE-Ins)

201 - Prelaunch
203 - Ascent (GSE-MECO)
205 - Ascent (MECO-Ins)
207 - APU Ascent
209 - MPS Dump and Inert
211 - Ascent (Ins-OMS2)
251 - Heaters, Ascent Phase 1 - Common (ASP1CM)
253 - Heaters, Ascent Phase 2 - Common (ASP2CM)
255 - Heaters, Ascent Phase 3 - Common (ASP3CM)
257 - Heaters, Ascent Phase 1/2 - Worst (ASP12W)
259 - Heaters, Ascent Phase 3 - Worst (ASP3W)
261 - Heaters, Ascent Phase 1 - Cold Day (ASP1CD)
263 - Heaters, Ascent Phase 2 - Cold Day (ASP2CD)
265 - Heaters, Ascent Phase 3 - Cold Day (ASP3CD)
271 - Heaters, Ascent Phase 1 - Warm Day (ASP1WD)
273 - Heaters, Ascent Phase 2 - Warm Day (ASP2WD)
275 - Heaters, Ascent Phase 3 - Warm Day (ASP3WD)

301 - OMS Maneuver (On-Orb)
303 - Forward RCS Maneuver
305 - Aft RCS Maneuver
307 - All OMS Maneuvers (On-Orb)
309 - RCS Attitude Control
311 - OMS Burns (ASC & DES)
313 - All Maneuvers (On-Orb)

401 - Orbital Configuration 1
403 - Delta Day
405 - Stationkeeping
407 - IMU Alignment
409 - Second Phase Rendezvous
411 - Docking
413 - Undocking
415 - Docking Module Operations
417 - EVA
419 - Post EVA
421 - Crew TV
423 - Food Prep/Eat
425 - Waste Management
427 - Pre/Post Sleep
429 - Crew Sleep
431 - Fuel Cell Purge
433 - Deorbit Prep 1
435 - Payload Bay Doors Opened
437 - Payload Bay Doors Closed
439 - Orbital Configuration 2*
441 - Deorbit Prep 2*
443 - Fuel Cell 3 Off-Line
445 - Fuel Cell 3 Off
447 - Fuel Cell 3 Activation
449 - Payload Interface
451 - Payload Deployment
453 - Payload Retrieval
455 - Payload Bay TV Operations
457 - Insertion to PLB Doors Open
459 - Orbital Configuration 1 Ascent
461 - Orbital Configuration 1 Rehearsal DP
463 - On Orbit FCS Checkout (FCSC/O)
465 - Post FCS Checkout (PSTFCS)
467 - Cryo Heaters A-O_2 Tank 1 (CTO1A)
469 - Cryo Heaters A-O_2 Tank 2 (CTO2A)
471 - Cryo Heaters B-O_2 Tank 1 (CTO1B)
473 - Cryo Heaters B-O_2 Tank 2 (CTO2B)
475 - Cryo Heaters A-H_2 Tank 1 (CTH1A)
477 - Cryo Heaters A-H_2 Tank 2 (CTH2A)
479 - Cryo Heaters B-H_2 Tank 1 (CTH1B)
481 - Cryo Heaters B-H_2 Tank 2 (CTH2B)
483 - Cryo Heaters A-O_2 Tank 3 (CTO3A)
485 - Cryo Heaters B-O_2 Tank 3 (CTO3B)
487 - Cryo Heaters A-H_2 Tank 3 (CTH3A)

489 - Cryo Heaters B-H_2 Tank 3 (CTH3B)
491 - Cryo Heaters A-O_2 Tank 4 (CTO4A)
493 - Cryo Heaters B-O_2 Tank 4 (CTO4B)
495 - Cryo Heaters A-H_2 Tank 4 (CTO4A)
497 - Cryo Heaters B-H_2 Tank 4 (CTO4B)

501 - Descent (Deorb-400Kft)
503 - Descent (400Kft-SR)
505 - Postlanding (SR-GSE)
507 - APU Descent
509 - Descent (Low Alt Ops)
551 - Heaters, Entry Nominal (ENTNOM)
553 - Heaters, Rollout Nominal (ROLNOM)
557 - Heaters, Entry Worst Case (ENTWST)
559 - Heaters, Rollout Worst Case (ROLWST)

601 - STS-1 Insertion - 10 hrs, PTC or ZLV
603 - STS-1 10.0 hrs - Deorbit Prep, PTC
605 - STS-1 Deorbit Prep to EI
607 - STS-2 - 1.5 - 93.1 hrs
609 - STS-2 - 93.1 hrs - Deorbit Prep
611 - STS-2 - Deorbit Prep to EI
613 - STS-3 - 1.5 - 10.0 hrs PTC
615 - STS-3 - 10.0 - 34.0 hrs 6/3, 6/3,
617 - STS-3 - 34.0 - 124.0 hrs +XSI
619 - STS-3 - 124.0 - 150.0 hrs +ZLV
621 - STS-3 - 150.0 hrs - Deorbit Prep
623 - STS-3 - Deorbit Prep to EI
625 -
627 -
629 -
631 -
633 - Other OFT Missions
635 - TBS
637 -
639 -
641 -
643 -
645 -

651 - (Deleted)
653 - (Deleted)
655 - OPS Htrs First 20 Hrs - Max Energy
657 - OPS Heaters - Beta = 00-40 Minimum Energy - Phase 1
659 - OPS Heaters - Beta = 00-40 Minimum Energy - Phase 2
661 - (Deleted)
663 - (Deleted)
665 - (Deleted)
667 - (Deleted)
669 - OPS Heaters - Beta = 00-40 Nominal Energy - Phase 1
671 - OPS Heaters - Beta = 00-40 Nominal Energy - Phase 2
673 - (Deleted)

675 - (Deleted)
677 - (Deleted)
679 - (Deleted)
681 - OPS Heaters - Beta = 00-90 Maximum Energy - Phase 1
683 - OPS Heaters - Beta = 00-90 Maximum Energy - Phase 2

*Activity Block presently undefined

5. Function and Usage

Function: - The general function of components of this type

Usage: - The intended and/or expected usage of components of this type, with emphasis on when components are energized

Analysis Usage:

OPS - Component usage in the performance of extended operational mission analyses

OFT - Component usage in the performance of orbital flight test analyses

STS 1 - Specific component usage for the first orbital flight test.

STS 2 - Specific component usage for the second orbital flight test.

A-I 0100
GUID. & NAV.

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
01010 INERTIAL MEAS UNITS				FUNCTION: In the Operate mode, the units provide an inertially stabilized reference for the Orbiter. The operating units output angular displacement and accumulated velocity data to the Data Processing Subsystem. The data are used by the assigned GNC computers for navigation and attitude control, and are processed for display to the crew via the CRT's (ref. 03270) and the ADI's (ref. 03010). Startracker data are used to periodically align operating IMU platforms, thereby maintaining an attitude reference accurate to within +/- 0.7 degrees. A unit must be realigned when going from Standby to Operate regardless of whether or not the unit was deactivated. In the Standby-Startup mode, heater power and temperature control amplifier are applied to warmup the unit from ambient cabin temperature to the operating temperature of approximately 150° F after which time the unit is said to be in the Standby mode. The time required is approximately 30 min. In the Standby mode, the unit is further temperature stabilized depending on the accuracy requirements of the unit. Gimbal angle requirements can normally be met with 30 min warmup while accelerometer scale factors may need 4.5 hr onorbit and up to 8.0 hr for entry. In the Slew mode, the IMU platform is torqued at a high rate (72 deg/min). This mode allows the platform to rapidly be moved to the vicinity of the desired angles. USAGE:

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Three units are required to be in Operate from prelaunch until the subsystem is reconfigured for orbital operations and from predeorbit IMU alignment through stoproll. The normal onorbit configuration, during noncritical periods, is one unit in Operate, one in Standby, and one off. Two units will be in Operate, and one off from approximately 1.5 hr prior to onorbit OMS burns, EVA's, or 2nd phase rendezvous operations through those activities, and during stationkeeping, docking, and undocking. Additional onorbit usage is a function of mission, as follows: STS-1 and 2 - Three units are required to be in Operate throughout the flight. Note: 1). Units which are in Operate continuously will be aligned twice a day. 2). The Standby unit will be placed in Operate and both Operating units will then be aligned approximately 1.5 hr prior to onorbit OMS burns, EVA's, and actual rendezvous. 3). Approximately 4.0 hr prior to deorbit, the unit which is off will be placed in standby. After a 2.5 hr warmup, the two Standby units will be placed in Operate, whereupon the three IMU's will be aligned simultaneously. 4). The Slew submode may be utilized whenever an IMU, which has been off or in Standby, is placed in Operate and aligned. The length of Slew operation will depend upon the amount of misalignment (2.5 min maximum).

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
01010100 IMU #1 OPERATE	121	7677	103,105,111, 505	On from pwr xfr int until 6 min 30 sec after stoproll
01010110 IMU #1 STANDBY	51	7677	None	Not used
01010120 IMU #1 SLEW	131	7677	None	Not used
01010130 IMU #1 STBY-START UP	121	7677	None	Not used
01010200 IMU #2 OPERATE	121	7677	103,105,111, 307,405,409, 411,413,417, 419,433,505	STS-1 - On from pwr xfr int until 6 min 30 sec after stoproll STS-2 - On from pwr xfr int until 6 min 30 sec after stoproll OPS - On from pwr xfr int until 30 min after OMS-2; on during any scheduled stationkeeping, docking, or undocking until completion of that activity; on from 1.5 hr prior to NCC until the initiation of stationkeeping; on from 1.5 hr prior to any scheduled onorbit OMS burns through the post-burn powerdown; on from 1.5 hr prior to any scheduled EVA until 15 min post EVA; on from 1.5 hr prior to deorbit until 6 min 30 sec after stoproll.
01010210 IMU #2 STANDBY	51	7677	105	STS-1 - Not used STS-2 - Not used

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On continuously from 30 min after OMS-2 until 1.5 hr prior to deorbit, except when IMU #2 is in the Operate mode (ref. 01010200) or the Slew mode (ref. 01010220)
01010220 IMU #2 SLEW	131	7677	307,409,417, 433	STS-1 - Not used STS-2 - Not used OPS - On for 2.0 min immediately prior to each time Operate mode is turned on for an OMS burn, an EVA, a rendezvous or re-entry (ref. 01010200)
01010230 IMU #2 STBY-START UP	121	7677	None	Not used
01010300 IMU #3 OPERATE	121	7677	103,105,111, 433,505	STS-1 - On from pwr xfr int until 6 min 30 sec after stoproll STS-2 - On from pwr xfr int until 6 min 30 sec after stoproll OPS - On from pwr xfr int until 30 min after OMS-2 and from 1.5 hr prior to deorbit until 6 min 30 sec after stoproll
01010310 IMU #3 STANDBY	51	7677	433	STS-1 - Not used STS-2 - Not used OPS - On from 4 hr prior to deorbit until 1.5 hr prior to deorbit, except when IMU #3 is in the Operate mode (ref. 01010300), the Slew mode (ref. 01010320), or the Standby-Startup mode

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				(ref. 01010330)
01010320 IMU #3 SLEW	131	7677	433	STS-1 - Not used STS-2 - Not used OPS - On for 2 min immediately prior to the time operate mode is turned on for re-entry (ref. 01010310)
01010330 IMU #3 STBY-START UP	121	7677	433	STS-1 - Not used STS-2 - Not used OPS - On for 30 min starting 4.5 hr prior to deorbit
01030 STAR TRACKERS				FUNCTION: Measure the angle to a star or sunlit rendezvous target and provide, as output to the assigned GNC computer(s),the data required to periodically correct IMU reference errors and/or to compute the guidance commands necessary to achieve rendezvous. There are two startrackers, one mounted so as to sight along the -Y axis and one mounted so as to sight along the -Z axis. Either startracker may be used independently for IMU platform alignment, or both units may be operated together. In general, alignments using two startrackers require shorter data-take periods and result in a more accurate IMU alignment. Each startracker is provided with a light shield to shade the field of view when tracking at relatively close angles to bright objects such as the Sun, the

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Earth, or the Moon. The startrackers require a 15 min warmup prior to use.

USAGE:

Startrackers are used in support of rendezvous and IMU alignment activities. They are used as a rendezvous aid when beyond the range of the Rendezvous Radar. One unit, however, will probably be on for the entire rendezvous period.

IMU alignments during OPS will normally be performed using automatic startracker data from both startrackers. This method of alignment requires a 15 min warmup period and a data-take period of about 90 min (one complete orbit) or less, dependent on altitude. All operating IMU platforms will nominally be aligned within the first three orbits after insertion; approximately every 12.0 hr onorbit; approximately 1.5 hr prior to onorbit OMS burns; and approximately 1.5 hr prior to deorbit. Additional usage is a function of mission, as follows:

A startracker will be on continuously during experiment operations, for those experiments which require a pointing accuracy greater than +/- 0.5 degrees.

STS-1 and 2 - One unit is required to be on from the beginning of the post insertion IMU alignment until deorbit. (May be turned off during sleep periods.) The second unit will be turned on for approximately 30 min for each scheduled manual alignment.

Note: 1). Data-take time is dependent on the Orbiter attitude and can be shortened by maneuvering the Orbiter to a more optimum

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				attitude. 2). IMU alignment is initiated by the crew when valid startracker data has been accumulated. The actual alignment is essentially instantaneous. 3). The IMU platforms may be aligned with one another at various times, such as stationkeeping, docking, undocking, and EVA's. This method of alignment does not require a startracker to be on.
01030100 STAR TRACKER -Z AXIS	17	7677	403,407,409	ANALYSIS USAGE: STS-1 - On for 30 min starting 15 min prior to all scheduled manual alignments STS-2 - Same as STS-1 OPS - On for 2nd phase rendezvous operations from NCC to the initiation of stationkeeping; on for 45 min starting 15 min prior to all scheduled IMU alignments; on with a 50% usage factor during the crew work day for earth observation missions
01030200 STAR TRACKER -Y AXIS	17	7677	401,403,407	STS-1 - On from OMS-2 C/O plus 1 hr until end of ascent reconfiguration, then on during the crew workday STS-2 - Same as STS-1 OPS - On for 45 min starting 15 min prior to all scheduled IMU alignments
01040				

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
AIR DATA TRANSDUCER ASSEMBLIES				FUNCTION: Process input pressure and temperature data, from the Air Data Probes, for output to the assigned GNC computer(s) upon request. The output data are used to compute angle-of-attack, dynamic pressure, mach number, air speed, altitude, and altitude rate. There are four ADTA's. Assemblies 1 & 3 are associated with the left probe and assemblies 2 & 4 are associated with the right probe. In normal operation, the GNC computer compares and selects the average of each probe pair. The outputs of these pairs are then continually compared and averaged. If all outputs properly compare, the average is provided to the GNC computer. If not, the computer automatically removes failed ADTA and repeats the process of comparison. Note: Each ADTA processes all pressure data. It is, however, undesirable to operate with only one active ADTA, due to degradation of data quality. USAGE: All on during ascent to support RTLS aborts. All turned on and tested approximately 3.0 hr prior to deorbit and remain on through stoproll. ANALYSIS USAGE:
01040100 ADTA #1	64	7677	051,103,111 401,433,505	STS-1 - On from pwr xfr int to OMS-2 plus 2 hr 40 min; from 6.0 hr prior to until 30 min after rehearsal deorbit; and from 6.0 hr prior to deorbit until 6 min 30 sec after stoproll

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - On from pwr xfr int to OMS-2 plus 2 hrs 40 min, and from 6.0 hrs prior to deorbit until 6 min 30 sec after stoproll OPS - On from pwr xfr int to OMS-2 plus 30 min and from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll
01040200 ADTA #2	64	7677	051,103,111 401,433,505	Same as 01040100
01040300 ADTA #3	64	7677	051,103,111, 401,433,505	Same as 01040100
01040400 ADTA #4	64	7677	051,103,111, 401,433,505	Same as 01040100
01080 ATVC PWR SUPPLIES				FUNCTION: Provide power for the ATVC driver electronics which translate guidance commands, from the GNC computer(s), into analog signals to control the hydraulic actuators which gimbal the SRB and MPS engines. The supplies also provide power for the actuator delta pressure transducers. There are four drivers, each providing an independent and redundant command channel to each of ten actuators (6-SSME, 3 pitch and 3 yaw; 4 SRB, 2 tilt and 2 rock). USAGE: Operate - On during active boost-phase guidance from L/O to MPS engine stow complete.

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Quiescent - On from prelaunch to L/O. On from MPS engine stow complete until deactivated by the crew after APU shutdown and seat egress. On approximately 1 hr prior to deorbit until stoproll plus approx 5 min. Switch operation is limited by crew access on OFT missions.
				ANALYSIS USAGE:
01080100 ATVC #1 PWR SUP-OPER	50	7677	207	On from lift-off to MECO plus 5 min 20 sec
01080110 ATVC #1 PWR SUP-QUES	39	7677	051,111,201, 211,401,433 505	STS-1 - On from prelaunch to L/O; on from MECO plus 5 min 20 sec through orbit reconfiguration. On for 2 hr on rehearsal day starting at 1 hr prior to deorbit TIG. On 1 hr prior to deorbit TIG until stoproll plus 5 min STS-2 - Same as OPS OPS - On from prelaunch to L/O; on from MECO plus 5 min 20 sec through orbit reconfiguration. On 1 hr prior to deorbit TIG until stoproll plus 5 min
01080200 ATVC #2 PWR SUP-OPER	50	7677	207	Same as 01080100
01080210 ATVC #2 PWR SUP-QUES	39	7677	051,111,201, 211,401,433, 505	Same as 01080110
01080300 ATVC #3 PWR SUP-OPER	50	7677	207	Same as 01080100
01080310 ATVC #3 PWR SUP-QUES	39	7677	051,111,201, 211,401,433,	Same as 01080110

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			505	
01080400 ATVC #4 PWR SUP-OPER	50	7677	007	Same as 01080100
01080410 ATVC #4 PWR SUP-QUES	39	7677	051,111,201, 211,401,433, 505	Same as 01080110
01081 ATVC ISOLATION VALVE DRIVERS				FUNCTION: Provide monitoring circuits which automatically inhibit an ATVC driver channel if a malfunction is indicated in that channel. USAGE: All on whenever the ATVC Power Supplies are on (see 01080). ANALYSIS USAGE:
01081100 ATVC #1 ISO VLV DRVR	<1	7677	None	Not used (low power)
01081200 ATVC #2 ISO VLV DRVR	<1	7677	None	Not used (low power)
01081300 ATVC #3 ISO VLV DRVR	<1	7677	None	Not used (low power)
01081400 ATVC #4 ISO VLV DRVR	<1	7677	None	Not used (low power)
01082 ATVC ACTUATORS				FUNCTION:

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide power for the torque motors and pressure transducers on the hydraulic actuators used for ATVC.
				USAGE:
				Operate - On during active boost-phase guidance from L/O to MPS engine stow complete.
				Quiescent - On from prelaunch to L/O, and from MPS engine stow complete until deactivated by the crew after APU shutdown.
				ANALYSIS USAGE:
01082100 ATVC #1 ACTS-OPER	9	7677	207	On from lift-off to MECO plus 5 min 20 sec
01082110 ATVC #1 ACTS-QUES	3	7677	051,111,201, 211,401,433, 505	STS-1 - On from prelaunch to L/O; on from MECO plus 5 min 20 sec through orbit reconfiguration. On for 2 hrs on rehearsal day starting at 1 hr prior to deorbit TIG. On 1 hr prior to deorbit TIG until stoproll plus 5 min
				STS-2 - Same as OPS
				OPS - On from prelaunch to L/O; on from MECO plus 5 min 20 sec through orbit reconfiguration. On 1 hr prior to deorbit TIG until stoproll plus 5 min
01082200 ATVC #2 ACTS-OPER	9	7677	207	Same as 01082100
01082210 ATVC #2 ACTS-QUES	3	7677	051,111,201, 211,401,433,	Same as 01082110

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			505	
01082300 ATVC #3 ACTS-OPER	9	7677	207	Same as 01082100
01082310 ATVC #3 ACTS-QUES	3	7677	051,111,201, 211,401,433, 505	Same as 01082110
01082400 ATVC #4 ACTS-OPER	9	7677	207	Same as 01082100
01082410 ATVC #4 ACTS-QUES	3	7677	051,111,201, 211,401,433, 505	Same as 01082110
01090 ASA PWR SPLY LOGIC				FUNCTION: Provide the power for the ASA electronics which translate guidance commands, from the GNC computer(s), into analog signals to control the aerosurface servo actuators. The supplies also provide power for the actuator position and delta pressure transducers and for failure detection circuits in the elevon and rudder/speedbrake channels. USAGE: Operate - On from L/O to MECO, for the duration of the onorbit FCS checkout, and from approximately 400K ft during descent until EOM. Quiescent - On from prelaunch to L/O, then from MECO until deactivated by the crew after APU shutdown and

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				seat egress. On from approximately 5 min prior to the onorbit FCS checkout until checkout initiation, and from approximately 3.0 hr prior to deorbit until approximately 400K ft. Switch operation is limited by crew access on OFT missions.
				ANALYSIS USAGE:
01090100 ASA1 PWR SUP LOG-OPR	52	7677	203,463,503, 505	On from lift-off to MECO; for the duration of the onorbit FCS checkout; and from 400K ft until EOM
01090110 ASA1 PWR SUP LOG-QUE	52	7677	201,205,211, 401,433,463, 501	STS-1 - On from pwr xfr int to lift-off; from MECO to OMS-2 plus 2 hr 40 min; from 5 min prior to FCS checkout until checkout initiation; from 6.0 hr prior to through rehearsal deorbit; and from 6.0 hr prior to deorbit until 400K ft STS-2 - On from pwr xfr int to lift-off; from MECO to OMS-2 plus 2 hrs 40 min; from 5 min prior to the FCS checkout until checkout initiation; and from 6 hrs prior to deorbit until 400K ft. OPS - On from pwr xfr int to lift-off, from MECO to insertion plus 10 min, from 5 min prior to FCS checkout until checkout initiation; and from 3.0 hr prior to deorbit until 400K ft
01090200 ASA2 PWR SUP LOG-OPR	52	7677	203,503,505	Same as 01090100 except not used for FCS checkout.
01090210 ASA2 PWR SUP LOG-QUE	52	7677	201,205,211, 401,433,501	Same as 01090110 except not used for FCS checkout.
01090300 ASA3 PWR SUP LOG-OPR	52	7677	203,503,505	Same as 01090200

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
01090310 ASA3 PWR SUP LOG-QUE	52	7677	201,205,211, 401,433,501	Same as 01090210
01090400 ASA4 PWR SUP LOG-OPR	52	7677	203,503,505	Same as 01090200
01090410 ASA4 PWR SUP LOG-QUE	52	7677	201,205,211, 401,433,501	Same as 01090210
01100 ASA IVD/BF				FUNCTION: Provides power for the failure detection and isolation circuitry which protects the elevon and rudder/speedbrake channels. In addition, three of the amplifiers provide power to drive the pilot valve for the bodyflap actuator. The Operate mode represents the power required when the bodyflap and the elevon or rudder/speedbrake channels are active. The Quiescent mode represents the power required when the bodyflap, elevon, and rudder/speedbrake channels are static. In the absence of a failure, only one bodyflap pilot valve will be active at a time. USAGE: Operate - The elevon and rudder/speedbrake channels will be in operate from L/O to MECO, for the duration of the onorbit FCS checkout, and from approximately 400K ft during descent until EOM. One of the bodyflap channels will be in operate during the onorbit FCS checkout and from approximately 400K ft during descent until EOM.

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Quiescent - All channels will be in quiescent from prelaunch to L/O, from MECO until deactivated by the crew after APU shutdown and seat egress. On from approximately 5 min prior to the onorbit FCS checkout until checkout initiation, and from approximately 3.0 hr prior to deorbit until approximately 400K ft.
				ANALYSIS USAGE:
01100100 ASA #1 IVD/BF-OPER	2	7677	203,463,503, 505	On from L/O to MECO, for the duration of the FCS checkout and from 400K ft to EOM
01100110 ASA #1 IVD/BF-QUES	<1	7677	None	Not used (low power)
01100200 ASA #2 IVD/BF-OPER	2	7677	203,503,505	Same as 01100100, except not used for FCS checkout.
01100210 ASA #2 IVD/BF-QUES	<1	7677	None	Not used (low power)
01100300 ASA #3 IVD/BF-OPER	2	7677	203,503,505	Same as 01100200
01100310 ASA #3 IVD/BF-QUES	<1	7677	None	Not used (low power)
01100400 ASA #4 IVD-OPER	1	7677	203,503,505	Same as 01100200
01100410 ASA #4 IVD-QUES	<1	7677	None	Not used (low power)
01101 ASA ACTUATORS				FUNCTION:

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide power for the torque motors and pressure transducers on the aero-surface actuators.
				USAGE
				Operate - On from L/O to MECO, for the duration of the onorbit FCS checkout, and from approximately 400K ft during descent until EOM.
				Quiescent - On from prelaunch to L/O, on from MECO until deactivated by the crew after APU shutdown and seat egress. On from approximately 5 min prior to the onorbit FCS checkout until checkout initiation, and on from approximately 3.0 hr prior to deorbit until approximately 400K ft.
				ANALYSIS USAGE:
01101100 ASA 1 ACTUATORS-OPER	36	7677	203,463,503 505	On from lift-off to MECO, for the duration of the onorbit FCS checkout, and from 400K ft until EOM
01101110 ASA 1 ACTUATORS-QUES	17	7677	201,205,211, 401,433,463, 501	STS-1 - On from pwr xfr int to lift-off; from MECO to OMS-2 plus 2 hr 40 min; from 5 min prior to the FCS checkout until checkout initiation; from 6.0 hr prior to through rehearsal deorbit; and from 6.0 hr prior to deorbit until 400K ft
				STS-2 - On from pwr xfr int to lift-off; from MECO to OMS-2 plus 2 hrs 40 min; from 5 min prior to the FCS checkout until checkout initiation; and from 6.0 hrs prior to deorbit until 400K ft
				OPS - On from pwr xfr int to lift-off; from MECO to insertion plus 10 min; from 5 min prior to the FCS checkout until checkout initiation; and from 3.0 hr prior to deorbit until 400K ft

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
01101200 ASA 2 ACTUATORS-OPER	36	7677	203,503,505	Same as 01101100, except not used for FCS checkout
01101210 ASA 2 ACTUATORS-QUES	17	7677	201,205,211, 401,433,501	Same as 01101110, except not used for FCS checkout
01101300 ASA 3 ACTUATORS-OPER	36	7677	203,503,505	Same as 01101200
01101310 ASA 3 ACTUATORS-QUES	17	7677	201,205,211, 401,433,501	Same as 01101210
01101400 ASA 4 ACTUATORS-OPER	17	7677	203,503,505	Same as 01101200
01101410 ASA 4 ACTUATORS-QUES	17	7677	201,205,211 401,433,501	Same as 01101210
01110 REAC JET DRVRS - FWD				FUNCTION: Control power to the propellant solenoids of the main forward RCS jets and the vernier forward RCS jets as commanded by the GNC computers; also supply status data to the GPC's. RJDF #1A is controlled via MDM FF2 RJDF #1B via MDM FF1, RJDF #2A via MDM FF4, while RJDF #2B is controlled via MDM FF3. USAGE: All on for ascent through OMS-2, for all OMS and RCS burns, and for 2nd phase rendezvous, stationkeeping, docking and undocking operations. The units will be

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				powered down to vernier only operation for the remainder of orbital operations except on STS-1 and 2. On the first STS missions the RJDF's will remain fully powered. They will be fully powered from the onorbit FCS checkout through stoproll on all missions.
				ANALYSIS USAGE:
01110100 RJDF #1A PRI RCS	11	7677	103,105,111, 313,401,405, 409,411,413, 433,505	STS-1 - On from pwr xfr int to stoproll plus 6 min 30 sec STS-2 - Same as STS-1 OPS - On from pwr xfr int to OMS-2 plus 30 min; on from 5 min prior to each OMS and RCS burn through the post burn powerdown; on for 2nd phase rendezvous operations, from NCC to the initiation of stationkeeping; on for stationkeeping, docking, and undocking operations; on from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll
01110200 RJDF #1B PRI RCS	11	7677	103,105,111, 313,401,405, 409,411,413, 433,505	STS-1 - On from pwr xfr int to stoproll plus 6 min 30 sec STS-2 - Same as STS-1 OPS - On from pwr xfr int to OMS-2 plus 30 min; on from 5 min prior to each OMS and RCS burn through the post-burn powerdown; on for 2nd phase rendezvous operations, from NCC to the initiation of stationkeeping; on for stationkeeping, docking, and undocking operations; on from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll
01110300 RJDF #2A PRI RCS	11	7677	103,105,111,	STS-1 - On from pwr xfr int to stoproll plus 6 min

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			313,401,405, 409,411,413, 433,505	30 sec STS-2 - Same as STS-1 OPS - On from pwr xfr int to OMS-2 plus 30 min; on from 5 min prior to each OMS and RCS burn through the postburn powerdown; on for 2nd phase rendezvous operations from NCC to the initiation of stationkeeping on for stationkeeping, docking, and undocking operations; on from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll.
01110400 RJDF #2B PRI/VN RCS	11	7677	103,105,111, 505	On from pwr xfr int to stoproll plus 6 min 30 sec
01120 REAC JET DRVRS-AFT				FUNCTION: Control power to the propellant solenoids of the main aft RCS jets and the vernier aft RCS jets as commanded by the GNC computers; also supply status data to the GPC's. RJDA #1A is controlled via MDM FA3, RJDA #1B via MDM FA1, RJDA #2A via MDM FA4 while RJDA #2B is controlled via MDM FA2. USAGE: All on for ascent through OMS-2, for all OMS and RCS burns and for 2nd phase rendezvous, docking and undocking operations. The units will be powered down to vernier only mode for the remainder of orbital operations except on STS-1 and 2. On the first STS missions the RJDA's will remain fully powered. They will be fully powered from the onorbit FCS checkout through stoproll on all missions.

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
01120100 RJDA #1A PRI RCS	13	7677	103,105,111, 313,401,405, 409,411,413, 433,505	STS-1 - On from pwr xfr int until 6 min 30 sec after stoproll STS-2 - Same as STS-1 OPS - On from pwr xfr int to OMS-2 plus 30 min; on from 5 min prior to each OMS and RCS burn through the post-burn powerdown; on for 2nd phase rendezvous operations from NCC to the initiation of stationkeeping; on for stationkeeping, docking, and undocking operations; on from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll
01120200 RJDA #1B PRI/VN RCS	16	7677	103,105,111, 505	On from pwr xfr int until 6 min 30 sec after stoproll
01120300 RJDA #2A PRI RCS	13	7677	103,105,111, 313,401,405, 409,411,413, 433,505	Same as 01120100
01120400 RJDA #2B PRI/VN RCS	16	7677	103,105,111, 505	On from pwr xfr int until 6 min 30 sec after stoproll
01130 RATE GYRO ASSEMBLIES				FUNCTION: Measure angular rates around the three Orbiter body axes and provide, as output to the assigned GNC computer(s), the data necessary to determine the Orbiter attitude and attitude rate during ascent and descent. The data are displayed to the crew via the ADI's

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				(ref. 03010). The spinup mode represents the power drawn until achieving synchronous speed following turn on (estimated 90 sec max). Note: 1). The RGA's require approximately 2 min warmup prior to use. 2). The RGA's have no function during orbital operations. USAGE: Operate Mode - The four assemblies will be on from prelaunch through OMS-2 and on OPS missions, from approximately 3.0 hr prior to deorbit through stoproll. Spinup Mode - On for a maximum of 90 sec at each activation. ANALYSIS USAGE:
01130100 RGA #1 OPR	25	7677	051,103,111, 401,433,505	STS-1 - On from pwr xfr int until 2 hr 40 min after OMS-2; from 6.0 hr prior to until 30 min after deorbit rehearsal, except when in Spinup mode, and from 6.0 hr prior to deorbit until 13 min after stoproll, except when in Spinup mode STS-2 - On from pwr xfr int until 2 hr 40 min after OMS-2; and from 6.0 hrs prior to deorbit until 13 min after stoproll, except when in Spinup mode. OPS - On from pwr xfr int until 30 min after OMS-2; on from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll except when in Spinup mode
01130110 RGA #1-SPINUP	36	7677	433	STS-1 - On for 30 sec beginning 6.0 hr prior to

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				rehearsal deorbit and for 30 sec beginning 6.0 hr prior to deorbit STS-2 - On for 30 sec beginning 6.0 hrs prior to deorbit. OPS - On for 30 sec beginning 3.0 hr prior to deorbit
01130200 RGA #2-OPR	25	7677	051,103,111, 401,433,505	Same as 01130100
01130210 RGA #2-SPINUP	36	7677	433	Same as 01130110
01130300 RGA #3-OPR	25	7677	051,103,111, 401,433,505	Same as 01130100
01130310 RGA #3-SPINUP	36	7677	433	Same as 01130110
01130400 RGA #4-OPR	25	7677	051,103,111, 401,433,505	Same as 01130100
01130410 RGA #4-SPINUP	36	7677	433	Same as 01130110
01140 ACCEL ASSY'S-FWD				FUNCTION: Operate in conjunction with the RGA's to provide vehicle normal and lateral acceleration feedback to the GPC's for Orbiter stabilization and control during aerodynamic flight. The quiescent mode represents the power drawn when no acceleration is being sensed.

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				All on from prelaunch through OMS-2 and on ATS missions, from 3.0 hr prior to deorbit until after stoproll. Warmup time is 5 min. When no acceleration is being sensed units will be in the quiescent mode.
				ANALYSIS USAGE:
01140100 ACCEL ASSY #1-OPER	2	7677	051,103,111, 401,433,505	STS-1 - On from pwr xfr int to OMS-2 plus 2 hr 40 min; from 6.0 hr prior to until 30 min after rehearsal deorbit; and from 6.0 hr prior to deorbit until 6 min 30 sec after stoproll
				STS-2 - On from pwr xfr int to OMS-2 plus 2 hrs 40 min; and from 6.0 hrs prior to deorbit until 6 min 30 sec after stoproll.
				OPS - On from pwr xfr int to OMS-2 plus 30 min; on from 3.0 hr prior to deorbit until 6 min 30 sec after stoproll
01140110 ACCEL ASSY #1-QUIES	2	7677	None	Not used (power accounted for in Operate mode)
01140200 ACCEL ASSY #2-OPER	2	7677	051,103,111, 401,433,505	Same as 01140100
01140210 ACCEL ASSY #2-QUIES	2	7677	None	Not used (power accounted for in Operate mode)
01140300 ACCEL ASSY #3-OPER	2	7677	051,103,111, 401,433,505	Same as 011140100
01140310				

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
ACCEL ASSY #3-QUIES	2	7677	None	Not used (power accounted for in Operate mode)
01140400 ACCEL ASSY #4-OPER	2	7677	051,103,111, 401,433,505	Same as 01140100
01140410 ACCEL ASSY #4-QUIES	2	7677	None	Not used (power accounted for in Operate mode)
01160 TRANS HND CNTLRS				FUNCTION: Provide manual capability to produce three-axis translation along the body axes by commanding appropriate RCS jet firings. There are two THC's, one on the left side of the forward flight station and one on the left side of the aft station. They are powered by their respective DDU's via the "Flt Controller Pwr" switch at each station. USAGE: The fwd THC is on from prelaunch through OMS-2, for all OMS burns and RCS burns performed at the forward station for 2nd phase rendezvous operations, for the onorbit FCS checkout, and from predeorbit through stoproll. The aft THC is on for RCS maneuvers performed at the aft station, when in the proximity of another vehicle, and for 2nd phase rendezvous activities Note: Since the THC's are powered by the same switch as the other controllers at a flight station, additional on times are a function of RHC requirements (see 01170). ANALYSIS USAGE:

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
01160100 THC - LH	3	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - On from pwr xfr to OMS-2 plus 2 hr 47 min; on from 30 min prior to OMS-3 until 30 min after OMS-4; on from 15 min after deorbit prep on rehearsal day until 1 hr 17 min after rehearsal; on 5 min prior to the onorbit FCS checkout until completion of the checkout; and on from 15 min after deorbit prep until 6 min 30 sec after stoproll STS-2 - On from pwr xfr int to OMS-2 plus 2 hr 47 min; on from 10 min prior to each OMS burn until burn termination; on from 5 min prior to the onorbit FCS checkout until checkout completion; and from 15 min after deorbit prep until 6 min 30 sec after stoproll OPS - On from pwr xfr int to OMS-2 plus 30 min; on from 10 min prior to each OMS burn until termination of the burn; on for 6 min starting 2 min prior to each Fwd RCS burn; on for 2nd phase rendezvous operations from NCC to the initiation of station-keeping; on 5 min prior to the onorbit FCS checkout until completion of checkout; on from 30 min prior to deorbit until 6 min 30 sec after stoproll
01160200 THC - AFT	3	7677	055,305,405, 409,411,413, 451,453	On for 6 min starting 2 min prior to RCS maneuvers performed at the aft station; on for the duration of docking, undocking, stationkeeping, throughout RMS checkout activities; and payload handling operations; on for 2nd phase rendezvous operations from NCC to the initiation of stationkeeping
01170 ROT HAND CNTLRS				FUNCTION: Provide manual capability to produce three-axis

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				rotation (roll, pitch, and yaw). Onorbit this is effected via control of the RCS jets and contingency control of OMS TVC; during descent it is effected by a combination of RCS jet and aero surface control, depending upon the altitude. During atmospheric flight, yaw control is transferred to the rudder pedals. There are three RHC's, one at each of the forward flight stations, and one at the aft station. They are powered by their respective DDU's via the "Flt Controller Pwr" switch at each station. USAGE: The two fwd RHC's are on from prelaunch through OMS-2, for all OMS burns and RCS maneuvers performed at the forward station, for the onorbit FCS checkout, and from predeorbit through stoproll. Both fwd and aft RHC's are on for 2nd phase rendezvous, from NCC to the initiation of stationkeeping. The aft RHC is on for RCS maneuvers performed at the aft station, when in the proximity of another vehicle, and for payload handling operations. Note: All controllers at each flight station are controlled by the same switch and must, therefore, be on concurrently. The RHC on-time requirements currently encompass the requirements of the other controllers and, therefore, are the drivers for the usage of the other controllers (see 01160, 01180, and 01190). ANALYSIS USAGE:
01170100 RHC - LH	5	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - Same as 01160100 STS-2 - Same as 01160100

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Same as 01160100
01170200 RHC - RH	5	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - Same as 01160100 STS-2 - Same as 01160100 OPS - Same as 01160100
01170300 RHC - AFT	5	7677	055,305,405, 409,411,413, 451,453	On for 6 min starting 2 min prior to each aft RCS maneuver; on for the duration of docking, undocking, stationkeeping; throughout the RMS checkout activities; and payload handling operations; on for 2nd phase rendezvous operations, from NCC to initiation of stationkeeping
01180 RUD PDL TRNSDCR ASYS				FUNCTION: Translate crew inputs from the rudder pedals into signals to effect manual yaw axis control (via the rudder) during atmospheric flight and manual nosewheel steering during rollout. There are two RPTA's, one at each of the forward flight stations. They are powered by their respective DDU's via the "Flt Controller Pwr" switch at each station. USAGE: OFT - Both required on from prelaunch through OMS-2, for the onorbit FCS checkout, and from prior to APU startup predeorbit through stoproll OPS - Both required on from prelaunch through OMS-2, for the onorbit FCS checkout, and for the atmospheric portion of descent through stoproll.

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: Since the RPTA's are powered by the same switch as the fwd RHC's, additional on-times are a function of RHC requirements (see 01170).
				ANALYSIS USAGE:
01180100 RPTA - LH	1	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - Same as 01160100 STS-2 - Same as 01160100 OPS - Same as 01160100
01180200 RPTA - RH	1	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - Same as 01160100 STS-2 - Same as 01160100 OPS - Same as 01160100
01190 SPD BRK THRST CTLRS				FUNCTION: Provide manual capability to control speedbrake operation during descent. There are two SBTC's, one at each of the forward flight stations. They are powered by their respective DDU's via the "Flt Controller Pwr" switch at each station. USAGE: OFT - Both required on from prelaunch through OMS-2, for the onorbit FCS checkout, and from prior to APU startup predeorbit through stoproll OPS - Both required on from prelaunch through OMS-2, for the onorbit FCS checkout, and for the

TABLE A-I.- GUIDANCE AND NAVIGATION SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				atmospheric portion of descent through stoproll. Note: Since the SBTC's are powered by the same switch as the fwd RHC's, additional on-times are a function of RHC requirements (see 01170). ANALYSIS USAGE:
01190100 SBTC - LH	2	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - Same as 01160100 STS-2 - Same as 01160100 OPS - Same as 01160100
01190200 SBTC - RH	2	7677	051,103,111, 301,303,307, 401,409,433, 463,505	STS-1 - Same as 01160100 STS-2 - Same as 01160100 OPS - Same as 01160100

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COMM

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02010 B&W TV MONITORS				FUNCTION: Provide the capability to monitor any of nine TV camera outputs (one camera at each end of payload bay, one in the keel bay, two per manipulator arm, and two portable color cameras in the crew compartment). Each of the monitors has the capability to display either the output of any single camera or the outputs of any two cameras simultaneously via split-screen. USAGE: Used for monitoring payload activities, crew activities, and manipulator operations; may be used for monitoring docking, separation, EVA's, etc. ANALYSIS USAGE:
02010100 B&W TV MONITOR #1	35	7677	055,411,413, 415,417,421, 451,453,455	STS-1 - On whenever camera 02030100 or camera 02040100 is on STS-2 - On whenever camera 02030100 or camera 02040100 is on OPS - On for 25 min beginning 15 min prior to any scheduled docking, and on for the duration of any scheduled undocking, EVA's, crew TV operations, docking module operations, RMS payload handling operations or payload bay TV operations
02010200 B&W TV MONITOR #2	35	7677	055,411,413, 415,417,421, 451,453,455	STS-1 - On whenever camera 02030200 or camera 02040200 is on STS-2 - On whenever camera 02030200 or camera 02040200 is on

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On for 25 min beginning 15 min prior to any scheduled docking, and on for the duration of any scheduled undocking, EVA's, crew TV operations, docking module operations, RMS payload handling operations or payload bay TV operations
02020 TV REMOTE CONTROL				FUNCTION: Provides the capability for the ground or the crew to remotely control the focus, zoom, pan, tilt, and iris of the B&W or color TV cameras. USAGE: On whenever any B&W or color TV camera is on. ANALYSIS USAGE:
02020000 REMOTE CONTROL UNIT	40	7677	055,411,413, 415,417,421, 451,453,455	STS-1 - On concurrently with any TV camera STS-2 - On concurrently with any TV camera OPS - On for 25 min beginning 15 min prior to any scheduled docking, and on for the duration of any scheduled undocking, EVA's, crew TV operations, docking module operations, RMS payload handling operations or payload bay TV operations
02021 VIDEO SW UNIT				FUNCTION: Provides the capability to route signals from various TV cameras to the TV monitors or various transmission paths. USAGE:

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				On whenever any B&W or color TV camera is on.
				ANALYSIS USAGE:
02021000 VIDEO SWITCHING UNIT	20	7677	055,411,413, 415,417,421, 451,453,455	STS-1 - Same as 02020000 STS-2 - Same as 02020000 OPS - Same as 02020000
02030 COLOR TV CAMERAS				FUNCTION: Provide the capability to transmit color TV from the crew compartment. The cameras are portable and have built-in monitors. The output may be downlinked on Ku-Band via the TDRS or on S-Band FM Direct via STDN (see 02040); it may also be viewed on a B&W monitor. USAGE: Used during orbital operations to transmit flight crew activities; may be used to transmit docking and separation for public/NASA information; may be used to observe and transmit payload and manipulator operations.
				ANALYSIS USAGE:
02030100 COLOR TV CAMERA #1	13	7677	055,411,413, 415,417,421, 455	STS-1 - On during crew TV operations STS-2 - On during crew TV operations and RMS checkout operation. On with a 40% usage factor during payload bay TV operations

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On for 25 min beginning 15 min prior to any scheduled docking, and on for the duration of any scheduled undocking, EVA's, crew TV operations, docking module operations. On during payload bay TV operations with a 20% usage factor.
02030200 COLOR TV CAMERA #2	13	7677	055,411,413, 415,417,421, 455	STS-1 - Same as 02030100 STS-2 - Same as 02030100 OPS - Same as 02030100
02031 COLOR CAM LENS ASSY'S				FUNCTION: Provide capability to adjust zoom, focus, and iris on the CCTV camera. The fourth motor operates the color wheel. USAGE: The color wheel motor operates continuously when the camera is on. The power consumed by this motor is represented by the standby mode. The other motors operate occasionally as required. ANALYSIS USAGE:
02031100 CLR CAM1 LN ASY-SBY	5	7677	055,411,413, 415,417,421, 455	STS-1 - On concurrently with camera 02030100 STS-2 - On concurrently with camera 02030100 OPS - On concurrently with camera 02030100
02031110 CLR CAM1 LN ASY-1 MT	8	7677	None	Not Used - Usage accounted for by motor #3

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02031120 CLR CAM1 LN ASY-2 MT	11	7677	None	Not Used - Usage accounted for by motor #3
02031130 CLR CAM1 LN ASY-3 MT	13	7677	055,411,413, 415,417,421, 455	Same as 02030100 except with a 10% usage factor
02031200 CLR CAM2 LN ASY-SBY	5	7677	055,411,413, 415,417,421, 455	STS-1 - On concurrently with camera 02030200 STS-2 - On concurrently with camera 02030200 OPS - On concurrently with camera 02030200
02031210 CLR CAM 2 LN ASY-1 MT	8	7677	None	Not Used - Usage accounted for by motor #3
02031220 CLR CAM 2 LN ASY-2 MT	11	7677	None	Not Used - Usage accounted for by motor #3
02031230 CLR CAM 2 LN ASY-3 MT	13	7677	055,411,413, 415,417,421, 455	Same as 02030200 except with a 10% usage factor
02032 COLOR CAM VIEW FNDR MONITORS				FUNCTION: Provide a display to the portable color TV camera operator to assist in pointing the camera. It is mounted to the top surface of the camera. USAGE: Same as portable color TV cameras.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
02032100 VIEW FINDER MON #1	4	7677	055,411,413, 415,417,421, 455	Same as component 02030100
02032200 VIEW FINDER MON #2	4	7677	055,411,413, 415,417,421, 455	Same as component 02030200
02040 PAYLOAD BAY TV CAMERAS				FUNCTION:
				Provide the capability to monitor and transmit TV of payload bay activities. There is one camera at each end of the payload bay, one at the wrist and elbow joints of each manipulator arm (right hand RMS is kitted), and provision for one in the keel bay. The output of any one of the TV cameras (see 02030) may be downlinked on Ku-Band via the TDRS or on S-Band FM Direct via STDN. Selection of the camera output to be downlinked may be made by either the ground or the crew.
				USAGE:
				Cameras will be used as required to monitor payload handling, docking, separation, EVA's, etc.
				ANALYSIS USAGE:
02040100 TV CAM B&W FWD PLB	13	7677	055,417,451, 453,455	STS-1 - On during payload bay TV activities
				STS-2 - On during payload bay TV activities and during the RMS checkout sequence

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On during any scheduled EVA's, manipulator operations, or payload bay TV operations
02040200 TV CAM COL AFT PLB	13	7677	055,417,451, 453,455	STS-1 - Same as 02040100 STS-2 - Same as 02040100 OPS - On during any scheduled EVA's, manipulator operations, or payload bay TV operations
02040300 TV CAM B&W-LRMS WRST	13	7637	055,451,453 455	STS-1 - N/A STS-2 - On during RMS checkout sequence OPS - On during any scheduled manipulator operations or payload bay TV operations
02040400 TV CAM B&W-LRMS ELBW	13	7637	055,451,453, 455	STS-1 - N/A STS-2 - Same as 02040300 OPS - Same as 02040300
02040500 TV CAM B&W KEEL BAY	13	7677	055,417,451, 453,455	STS-1 - Same as 02040100 STS-2 - Same as 02040100 OPS - Same as 02040100
02041 PAYLOAD BAY CAM LENS ASSY'S				FUNCTION: Provides the capability to adjust zoom, focus, and

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				iris on the payload bay TV cameras.
				USAGE:
				Some power is required to maintain the B&W lens units in a standby condition. The other B&W lens assembly motors are used as required during B&W camera operation to adjust zoom, focus, or iris. The color wheel motor of the color lens assembly operates continuously when the camera is on. The power consumed by this motor is represented by the standby mode.
				ANALYSIS USAGE:
02041100 B&W CAM LN FWD-SBY	1	7677	None	Not used - (low power)
02041110 B&W CAM LN FWD-1 MTR	3	7677	None	Not used - Usage accounted for by motor #3
02041120 B&W CAM LN FWD-2 MTR	6	7677	None	Not used - Usage accounted for by motor #3
02041130 B&W CAM LN FWD-3 MTR	6	7677	055,417,451, 453,455	STS-1 - Same as 02040100 except with a 30% usage factor
				STS-2 - Same as 02040100 except with a 30% usage factor
				OPS - Same as 02040100 except with a 10% usage factor
02041200 TV CAM AFT CLR LN-SB	5	7677	055,417,451, 453, 455	STS-1 - On concurrently with camera 02040200
				STS-2 - On concurrently with camera 02040200

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On concurrently with camera 02040200
02041210 TV CAM AFT CLR LN-1M	8	7677	None	Not used - Usage accounted for by motor #3
02041220 TV CAM AFT CLR LN-2M	11	7677	None	Not used - Usage accounted for by motor #3
02041230 TV CAM AFT CLR LN-3M	13	7677	055,417,451, 453, 455	STS-1 - Same as 02040200 except with a 30% usage factor
				STS-2 - Same as 02040200 except with a 30% usage factor
				OPS - Same as 02040200 except with a 10% usage factor
02041300 B&W CAM LNS WRST-SBY	1	7637	None	STS-1 - N/A
				STS-2 - Not used (low power)
				OPS - Not used (low power)
02041310 B&W CAM LNS WR-1 MTR	3	7637	None	Not used - Usage accounted for by motor #3
02041320 B&W CAM LNS WR-2 MTR	6	7637	None	Not used - Usage accounted for by motor #3
02041330 B&W CAM LNS WR-3 MTR	8	7637	055,451,453, 455	STS-1 - N/A
				STS-2 - Same as 02040300 except with a 30% usage factor
				OPS - On concurrently with camera 02040300 except

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				with a 10% usage factor
02041400 BW CAM LNS ELB-SBY	1	7637	None	STS-1 - N/A STS-2 - Not used (low power) OPS - Not used (low power)
02041410 B&W CAM LN ELB-1 MTR	3	7637	None	Not used - Usage accounted for by motor #3
02041420 B&W CAM LN ELB-2 MTR	6	7637	None	Not used - Usage accounted for by motor #3
02041430 B&W CAM LN ELB-3 MTR	8	7637	055,451, 453,455	STS-1 - N/A STS-2 - On concurrently with camera 02040400 except with a 30% usage factor OPS - On concurrently with camera 02040400 except with a 10% usage factor
02041500 B&W CAM LENS KEEL-SBY	1	7677	None	Not used (low power)
02041510 B&W CAM LN KEL-1 MTR	3	7677	None	Not used - Usage accounted for by motor #3
02041520 B&W CAM LN KEL-2 MTR	6	7677	None	Not used - Usage accounted for by motor #3
02041530 B&W CAM LN KEL-3 MTR	8	7677	055,417,451, 453,455	STS-1 - On concurrently with camera 02040500 except with a 30% usage factor

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - On concurrently with camera 02040500 except with a 30% usage factor
				OPS - On concurrently with camera 02040500 except with a 10% usage factor
02050 PAN TILT ASSY'S				FUNCTION: Provide the capability for the ground or the crew to remotely control pan and tilt of each of the TV cameras in the payload bay.
				USAGE: Units are powered to the standby mode whenever associated camera is on. It is estimated that the peak power usage, required while driving, will occur approximately 20% of the time.
				ANALYSIS USAGE:
02050100 PAN TILT ASY FWD SBY	1	7677	None	Not used - (low power)
02050110 PAN TLT ASY FWD-1 MT	3	7677	None	Not used - Usage accounted for by motor #2
02050120 PAN TLT ASY FWD-2 MT	6	7677	055,417,451, 453,455	STS-1 - On concurrently with camera 02040100 except with a 20% usage factor
				STS-2 - On concurrently with camera 02040100 except with a 20% usage factor
				OPS - On concurrently with camera 02040100 except with a 10% usage factor

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02050200 PAN TILT ASY AFT SBY	1	7677	None	Not used (low power)
02050210 PAN TLT ASY AFT-1 MT	3	7677	None	Not used - Usage accounted for by motor #2
02050220 PAN TLT ASY AFT-2 MT	6	7677	055,417,451, 453,455	STS-1 - On concurrently with camera 02040200 except with a 20% usage factor STS-2 - On concurrently with camera 02040200 except with a 20% usage factor OPS - On concurrently with camera 02040200 except with a 10% usage factor
02050300 PAN TLT ASY KEEL-SBY	1	7677	None	Not used (low power)
02050310 PAN TLT ASY KEL-1 MT	3	7677	None	Not used - Usage accounted for by motor #2
02050320 PAN TLT ASY KEL-2 MT	6	7677	055,417,451, 453,455	STS-1 - On concurrently with camera 02040500 except with a 20% usage factor STS-2 - On concurrently with camera 02040500 except with a 20% usage factor OPS - On concurrently with camera 02040500 except with a 10% usage factor
02050400 PAN TLT ASY LRMS-SBY	1	7637	None	STS-1 - N/A STS-2 - Not used (low power)

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Not used (low power)
02050410 PAN TLT ASY LRMS-1 MT	3	7637	None	STS-1 N/A STS-2 - Not used - Usage accounted for by motor #2 OPS - Not used - Usage accounted for by motor #2
02050420 PAN TLT ASY LRMS-2 MT	6	7637	055,451,453, 455	STS-1 - N/A STS-2 - On during RMS checkout operations with a 30% usage factor OPS - On during any scheduled manipulator operations or payload operations except with a 20% duty cycle
02060 VIDEO TAPE RECORDER				FUNCTION: Tapes and plays back from B&W TV monitors. USAGE: To be used as required to video tape payload or manipulator activities, docking module operations, EVA's, etc.
02060000 VIDEO TP RECORD-OPR	30	7677	055,417,451, 453,455	ANALYSIS USAGE: STS-1 - Same as component 02040100 except with a 75% duty cycle STS-2 - Same as component 02040100 except with a 75% duty cycle

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Same as component 02040100 except with 25% usage factor
02060010 VIDEO TP RECORD-STBY	3	7677	None	Not used - Usage accounted for in operate mode
02074 RMS REMOTE VIDEO SWITCH				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
02074000 REMOTE VIDEO SW-RMS	1	7637	None	STS-1 - N/A STS-2 - Not used (low power) OPS - Not used (low power)
02080 NTWK SIG PROCESSORS				FUNCTION: Provide the interface signal processing of operational digital data for S-Band PM and Ku-Band reception and transmission. They also provide the fixed 128 KBPS operational data interleaved with digitized voice for recording and a hardlined output of voice and data (time-shared with RF) for GSE access. The two units are redundant. USAGE: One on continuously throughout all missions; only one will be on at a time. ANALYSIS USAGE:

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02080100 NTWK SIG PROCESSOR 1	31	7677	None	Not used (redundant equipment)
02080210 NTWK SIG PROCESSOR 2	31	7677	101	On from pwr xfr int to EOM
02100 S-BND PLD SWITCH (COAX)				FUNCTION: Provides the capability to switch Payload Interrogator 1 or 2 to the Payload antenna. This is a latching switch which requires only momentary power to operate. USAGE: Momentary usage only. ANALYSIS USAGE:
02100000 S-BND FM SW (COAX)	<1	7603	None	Not used (energy insignificant)
02110 S-BAND FM XMITRS				FUNCTION: Provide FM transmission of either Main Engine data, TV, recorder dumps, or P/L data to ground sites direct. Downlink selection is controlled by ground command or by the crew. The two units are redundant and only one will be on at a time. USAGE: One on from 20 min prior to launch until insertion; one on on-orbit as required for recorder dumps, TV, or wide-band P/L data. One may be on during descent for specific payload requirements. Estimated ground site coverage is 22 - 24%.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
02110100 S-BND FM XMITR #1	76	7677	055,105,123, 211,411,413, 415,417,421, 451,453,455	On from pwr xfr int to insertion, on with a 15% usage factor from insertion to deorbit. Increase to a 50% usage factor for 25 min, beginning 15 min prior to any scheduled docking, and for the duration of any scheduled undocking, EVA's, crew TV operations, manipulator operations, payload bay TV operations, RMS checkout activities or docking module operations
02110210 S-BND FM XMITR #2	74	7677	None	Not used (redundant equipment)
02120 S-BND FM SIG PROC				FUNCTION:
				Provides amplification, impedance matching, and data selection for the data inputs to the S-Band FM Transmitter. It also provides a hardlined output of the data for GSE access. This unit is internally redundant (two in one box) with each redundant sub-unit powered from a different bus.
				USAGE:
				One on when an FM Transmitter is on or when hardlined data is required during pre-launch.
				ANALYSIS USAGE:
02120000 S-BND FM SIG PRO-ORB	5	7677	055,105,123, 211,411,413, 415,417,421, 451,453,455	On from pwr xfr int to insertion, on with a 15% usage factor from insertion to deorbit. Increase to a 50% usage factor for 25 min, beginning 15 min prior to any scheduled docking, and during any scheduled undocking, EVA's, crew TV operations, manipulator operations, payload bay TV operations, RMS checkout activities

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				or docking module operations
02120010 S-BND FM SIG PRO-GND	6	7677	None	Not used (GSE power)
02130 S-BND XPONDERS				FUNCTION: Provide S-Band RF reception and transmission paths for operational voice, data, commands, ranging, and doppler (1 and 2 way). This unit downlinks the data required for the ground to assist the crew in achieving manual acquisition of TDRS Ku-Band. The two units are redundant. USAGE: Direct Mode - One on for direct transmission to STDN/ SGLS when TDRS is not available. TDRS Mode - One on for transmission through the TDRS during Ascent/Descent. One on continuously on-orbit when the Ku-Band System is not available or is in the Radar Mode. One on for approximately 12 min/rev- olution regardless of Ku-Band status to permit ranging through the TDRS. Receive Mode - One on continuously on-orbit when the Ku-Band System is the prime communications link. ANALYSIS USAGE:
02130100 S-BND XPNDR #1-DIRECT	64	7677	None	OFT - Not used OPS - Not used
02130110				

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
S-BND XPNDR #1-TDRS	41	7677	None	Not used
02130120 S-BND XPDR#1-RECEIVE	31	7677	None	Not used
02130210 S-BND XPNDR #2-DIRECT	64	7677	101	OFT - On from pwr xfr int to EOM OPS - Not used
02130220 S-BND XPNDR #2-TDRS	41	7677	109,123,405, 409,411,413, 435,437,457	OFT - Not used OPS - On from pwr xfr int to 30 sec after radiator deployment (switch to KU-Band System operation) from PLB Doors close initiation to EOM; from 1 hr prior to NCC, during rendezvous, until 10 min after docking; and from 15 min prior to undocking until the end of the separation burn Note: Ranging operation not simulated because of negligible energy impact
02130230 S-BND XPDR#2-RECEIVE	31	7677	435	OFT - Not used OPS - On continuously on-orbit except when the TDRS Mode is on
02140 S-BND PWR AMP ASSY				FUNCTION: Provides RF power amplification of the S-Band Transponder downlink. The assembly contains dual power amplifiers powered from separate buses. Only one unit may be in Operate at a time, the second unit may be in Standby.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				One unit in Operate and one in Standby during ascent and descent. After TDRS availability one unit will also be used on-orbit. It will be operated in Standby while the Transponder is in Receive and will be switched to Operate when the Transponder is switched to the TDRS mode for downlink or ranging.
				ANALYSIS USAGE:
02140100 S-BND PWR AMP 1-OPR	373	7677	None	Not used
02140110 S-BND PWR AMP 1-SBY	22	7677	005,109,123, 435,437,457	On from pwr xfr int to 30 sec after radiator deployment, and from PLB Doors close initiation to EOM
02140210 S-BND PWR AMP 2-OPR	384	7677	005,109,123, 405,409,411, 413,435,437, 457	OFT - On from pwr xfr int to 30 sec after radiator deployment; on from PLB Doors close initiation to EOM OPS - On from pwr xfr int to 30 sec after radiator deployment (switch to Ku-Band system operation); cycles from then until 10 hrs after open initiation with a 45 min period and a 13% duty cycle to simulate TDRS ranging; on with a 17.5% usage factor during remainder of on-orbit stay (except during rendezvous); on from 1 hr prior to NCC, during rendezvous, until 10 min after docking; from 15 min prior to undocking until the end of the separation burn; and from PLB Doors close initiation to EOM Note: The 17.5% usage on-orbit accounts for the ranging and the intervening standby mode power consumption

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02140220 S-BND PWR AMP 2-SBY	22	7677	435	OFT - Not used OPS - On from 30 sec after radiator deployment until 10 hrs after open initiation, off thereafter Note: Power consumption for remainder of on-orbit standby mode usage is accounted for by operate mode usage
02150 S-BAND PREAMP ASSYS				FUNCTION: Operate Mode - Provides amplification of received S-Band signals going to the S-Band Transponder. The assembly contains dual amplifiers powered from separate buses. Only one unit may be in operate at a time. Operate Startup Mode - Includes the 10 watt heater which is used to heat the unit to the operating temperature and the full operate mode electronics. Standby Mode - Provides operational capability within 10 seconds. Standby Startup Mode - Includes the 10 watt heater which is used to heat the unit to the operating temperature and the Standby mode electronics. USAGE: Operate Mode - One unit will be in Operate during ascent and descent. When TDRS coverage is available, one unit will be in the operate mode continuously.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Operate Startup Mode - This power level will only be drawn if the unit is switched directly from off to operate without first switching to standby. Standby Mode - One unit will be in Standby during ascent and descent to ensure a backup capability in the event that the primary unit fails. Standby Startup Mode - This power level will be drawn until the unit reaches operating temperature (10 min max) after being initially switched from off to standby.
				ANALYSIS USAGE:
02150100 S-BD PREAMP 1-OPR SU	34	7677	None	Not used
02150110 S-BD PREAMP 1-OPR	20	7677	None	Not used
02150120 S-BD PREAMP 1-SBY SU	20	7677	None	Not used
02150130 S-BD PREAMP 1-STBY	14	7677	051,103,109, 401,433	STS-1 - On from pwr xfr int until 10 min after OMS-2, from 1 hr prior to until 10 min after rehearsal deorbit, and from 1 hr prior to deorbit until EOM STS-2 - On from pwr xfr int until 10 min after OMS-2, and from 1 hr prior to deorbit until EOM OPS - On from pwr xfr int until 10 min after OMS-2, and from 1 hr prior to deorbit until EOM
02150200 S-BD PREAMP 2-OPR SU	34	7677	None	Not used

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02150210 S-BD PREAMP 2-OPR	20	7677	051,103,107, 109,401,433	STS-1 - On from pwr xfr int until 10 min after OMS-2, from 1 hr prior to until 10 min after rehearsal deorbit, and from 1 hr prior to deorbit until EOM STS-2 - On from pwr xfr int until 10 min after OMS-2, and from 1 hr prior to deorbit until EOM OPS - On from pwr xfr int to EOM
02150220 S-BD PREAMP 2-SBY SU	20	7677	None	Not used
02150230 S-BD PREAMP 2-STBY	14	7677	None	Not used
02160 S-BND ANT SW ASSY				FUNCTION: Provides the capability to switch the PM transponders between the four PM antennas and the FM transmitters between the two FM antennas. There are two power supplies for the PM switch and two for the FM switch, all of which are powered continuously. The switches may be controlled automatically through the GPC's or by crew or ground command. The switches are latching and require only momentary power to operate. USAGE: The power supplies are on continuously throughout all missions. The PM and FM switches are actuated during each STDN station pass for 100 ms at each AOS and LOS. ANALYSIS USAGE:

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02160000 S-BND ANT SW ASY-QES	1	7677	None	Not used (low power)
02160010 S-BND ANT SW ASY-PM	35	7677	None	Not used (momentary power)
02160020 S-BND ANT SW ASY-FM	15	7677	None	Not used (momentary power)
02170 TACANS				FUNCTION: Provide slant range and magnetic bearing, to ground beacon. Data from the three units are voted in the GPC and utilized to update the state vector and to drive the Horizontal Situation Indicators via a DDU. Also receives and decodes an identity tone from the ground station and provides a corresponding audio output to the intercom. The search mode represents the power consumed when the unit has not achieved "lock" with a ground beacon. USAGE: All on from pwr xfr int to insertion plus 15 min to support RTLS aborts. All on from the beginning of deorbit preparations until sometime after stoproll. During STS 1 and 2, all will remain on until the GO/NO GO for 24 hrs of flight. When on, the units will be in the search mode until TACAN acquisition at approximately 10 min prior to touchdown. ANALYSIS USAGE:
02170100 TACAN #1 SEARCH	160	7677	123,211,401 433,501,503	STS-1 - On from pwr xfr int to OMS-2 plus 2 hrs 40 min, from 6.0 hrs prior to until the end of de-orbit rehearsal, and from 6.0 hrs prior to deorbit

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				until entry interface plus 20 min STS-2 - On from pwr xfr int to OMS-2 plus 2 hrs 40 min, and from 6.0 hrs prior to deorbit until entry interface plus 20 min OPS - On from pwr xfr int to insertion plus 15 min and from 3.0 hrs prior to deorbit until entry interface plus 20 min
02170110 TACAN #1 XMIT/REC	150	7677	503,505	On from entry interface plus 20 min until EOM
02170200 TACAN #2 SEARCH	160	7677	123,211,401, 433,501,503	Same as 02170100
02170210 TACAN #2 XMIT/REC	150	7677	503,505	Same as 02170110
02170300 TACAN #3 SEARCH	160	7677	123,211,401, 433,501,503	Same as 02170100
02170310 TACAN #3 XMIT/REC	150	7677	503,505	Same as 02170110
02190 MSBLS DCDR ASSY'S				FUNCTION: Operate in conjunction with the MSBLS RF Assemblies to determine the elevation angle, azimuth angle and range of the Orbiter with respect to the landing site. Data from the three units are voted in the GPC and utilized to update the state vector and to drive the Horizontal Situation Indicators via a DDU.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				None are on during ascent except to support AOA aborts at approximately 1 hr 7 min after lift-off. All on from the beginning of deorbit preparations until sometime after stoproll.
				ANALYSIS USAGE:
02190100 MSBLS DCDR ASSY #1	55	7677	111,433,505	STS-1 - On from 6.0 hrs prior to until the end of deorbit rehearsal, and from 6.0 hrs prior to deorbit until stoproll plus 6 min 30 sec
				STS-2 - On from 6.0 hrs prior to deorbit until stoproll plus 6 min 30 sec
				OPS - On from 3.0 hrs prior to deorbit until stoproll plus 6 min 30 sec
02190200 MSBLS DCDR ASSY #2	57	7677	111,433,505	Same as 02190100
02190300 MSBLS DCDR ASSY #3	52	7677	111,433,505	Same as 02190100
02200 MSBLS RF ASSY'S				FUNCTION:
				Operate in conjunction with the MSBLS Decoder Assemblies to determine the elevation angle, azimuth angle and range of the Orbiter with respect to the landing site.
				USAGE:

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				None are on during ascent except to support AOA aborts at approximately 1 hr 7 min after lift off. All on from the beginning of deorbit preparations until sometime after stoproll.
				ANALYSIS USAGE:
02200100 MSBLS RF ASSY #1	15	7677	111,433,505	STS-1 - On from 6.0 hrs prior to until the end of deorbit rehearsal, and from 6.0 hrs prior to deorbit until stoproll plus 6 min 30 sec STS-2 - On from 6.0 hrs prior to deorbit until stoproll plus 6 min 30 sec OPS - On from 3.0 hrs prior to deorbit until stoproll plus 6 min 30 sec
02200200 MSBLS RF ASSY #2	16	7677	111,433,505	Same as 02200100
02200300 MSBLS RF ASSY #3	15	7677	111,433,505	Same as 02200100
02210 RADAR ALTIMETERS				FUNCTION: Provide accurate altitude data to the DPS and to the AVVI via a DDU during the final landing phase. USAGE: Provides useful data during descent from 5000 ft to touchdown. Both on from pwr xfr int to insertion plus 15 min to support RTLS aborts. Both on from the beginning of deorbit preparations until sometime after stoproll. During STS 1 and 2, all will remain on until the GO/NO GO for 24 hrs of flight.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
02210100 RADAR ALTIMETER #1	23	7677	111,123,211, 401,433,505	STS-1 - On from pwr xfr int to OMS-2 plus 2 hrs 40 min, from 6.0 hrs prior to until the end of deorbit rehearsal, and from 6.0 hrs prior to deorbit until stoproll plus 6 min 30 sec STS-2 - On from pwr xfr int to OMS-2 plus 2 hrs 40 min, and from 6.0 hrs prior to deorbit until stopover plus 6 min 30 sec OPS - On from pwr xfr int to insertion plus 15 min and from 3.0 hrs prior to deorbit until stoproll plus 6 min 30 sec
02210200 RADAR ALTIMETER #2	23	7677	111,123,211, 401,433,505	Same as 02210100
02220 UHF XCVRS				FUNCTION:
				UHF ATC/EVA XCVR - A system of three transmitters and four receivers which operate in three different modes. The system provides simplex voice communication between the Orbiter and both the chase planes and the ground, and duplex communication between the Orbiter and EVA crewmen. It also receives data from the EMU for relay to the ground. The EVA mode utilizes one xmtr and two rcvrs, the ATC REC mode utilizes one xmtr (keyed) and one rcvr, and the ATC XMT/REC mode utilizes one xmtr (keyed) and two rcvrs. UHF XCVR - A standard ATC transceiver providing simplex voice communication between the Orbiter and both

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				the chase planes and the ground. It is utilized for those missions flown prior to the availability of the ATC/EVA XCVR.
				USAGE:
				EVA - On from pre-EVA checkout until approximately 1 hr post-EVA. (Ref. 02220000)
				ATC REC - On from pwr xfr int until post-insertion power down and from deorbit preps power up until EOM, except when in ATC XMT/REC. (Ref. 02220010)
				ATC XMT/REC - On about 50% of the time from pwr xfr int until post-insertion power down and from deorbit preps power up until EOM. (Ref. 02220020)
				UHF XCVR - On about 50% of the time from pwr xfr int until post-insertion power down and from deorbit prep power up until EOM (Ref. 02220110)
				ANALYSIS USAGE:
02220000 UHF ATC/EVA XCVR	150	7617	417,419	OFT - N/A
				OPS - On from 1.0 hr prior to any scheduled EVA until 1.0 hr post-EVA
02220010 UHF ATC/EVA-XMT/REC	120	7617	109,123,211	OFT - N/A
				OPS - On with a 62.5% usage factor from pwr xfr int to insertion plus 15 min, and from deorbit minus 30 min to EOM
02220020 UHF ATC/EVA XCVR-REC	30	7617	None	Not used - Energy accounted for by XMT/REC mode usage

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02220110 UHF XCVR-XMT/REC	93	0077	051,109,123, 211,433	STS-1 - On with a 62.5% usage factor from pwr xfr int to insertion plus 15 min, from 30 min prior to until 15 min after rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On with a 62.5% usage factor from pwr xfr int to insertion plus 15 min, and from 30 min prior to deorbit until ECM OPS - N/A
02220120 UHF XCVR-REC	23	0077	None	Not used - Energy accounted for by XMT/REC mode usage
02280 COMSEC UNITS				FUNCTION: Encrypt downlink time division multiplexed TM and digital voice and decrypt uplink time division multiplexed TM and digital voice. The two units are redundant. USAGE: One on continuously throughout all DOD missions and mixed missions when DOD payload is active. When not on, units must be in standby to retain the internal memory. ANALYSIS USAGE:
02280100 COMSEC UNIT #1	25	7677	101	On from pwr xfr int to EOM on DOD missions
02280110 COMSEC UNIT #1 STBY	2	7677	None	Not used (redundant equipment)

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02280200 COMSEC UNIT #2	25	7677	None	Not used (redundant equipment)
02280210 COMSEC UNIT #2 STBY	2	7677	101	On from pwr xfr int to EOM on DOD missions
02290 PLD INTERROGATOR CONTROLLERS				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE: TBD
02290100 PLD INTR #1 CNTL PWR	2	7603	None	
02290210 PLD INTR #2 CNTL PWR	2	7603	None	Not used - (Redundant equipment)
02300 PLD INTERROGATORS				FUNCTION: Provide an S-Band RF transmitter and receiver for transmitting commands to and receiving TM from payloads. The commands may originate from the ground or the Orbiter. The TM is downlinked via the Payload Signal Processors through the Payload Data Interleaver. The two units are redundant. USAGE: One on as required to support RF payload activities. Only one unit is on at a time. ANALYSIS USAGE:

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02300100 PLD INTERROGATOR #1	113	7603	None	Not used (usage TBD)
02300210 PLD INTERROGATOR #2	113	7603	None	Not used (redundant equipment)
02310 PLD SIG PROCESSORS				FUNCTION: Perform rate buffering of commands being sent to payloads via the Payload Interrogator. Demodulate, bit sync, frame sync, and transfer data received from payloads to the Payload Data Interleaver. USAGE: One on when the associated Payload Interrogator is on to support RF payload activities (see 02300), and one on to support certain attached payloads. ANALYSIS USAGE:
02310100 PLD SIG PROCESSOR #1	32	7603	None	Not used (usage TBD)
02310210 PLD SIG PROCESSOR #2	32	7603	None	Not used (usage TBD)
02410 AUDIO CENTERS				FUNCTION: Provide crew control of voice intercom, RF interfaces, and hardlined access terminals; routes, switches, and controls voice access to the RF links. This unit is internally redundant (two in one box) with each redundant sub-unit powered from a different bus.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				One on continuously throughout all missions.
				ANALYSIS USAGE:
02410100 AUDIO CENTER 1	40	7677	101	On from pwr xfr int to EOM
02410210 AUDIO CENTER 2	40	7677	None	Not used (redundant equipment)
02420 AUDIO TERM UNITS				FUNCTION:
				Provide audio selection and conditioning at audio stations. One headset can be connected to each unit.
				USAGE:
				One on per crewman during the crew workday. One on in the Mid-Deck area when all crewmen are asleep.
				ANALYSIS USAGE:
02420100 AUDIO TERM UN-PLT RT	4	7677	051,103,109, 401,403,433	On from pwr xfr int until EOM when any crewmen are awake
02420200 AUDIO TERM UN-CDR LT	4	7677	051,103,109, 401,403,433	On from pwr xfr int until EOM when any crewmen are awake
02420300 AUDIO TERM UNIT-MSS	4	7677	051,103,109, 401,403,433	Same as 02420100
02420400 AUDIO TERM UNIT-PS	4	7677	051,103,109,	STS-1 - Same as 02420100

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			305,401,403, 405,409,411, 413,433,451, 453	STS-2 - Same as 02420100 OPS - On from OMS-2 to OMS-2 plus 1 hr, from 30 min prior to any RCS maneuver performed from the aft station through the post burn powerdown, from 1 hr prior to NCC through the completion of rendezvous, for the duration of stationkeeping, docking, undocking, from 30 min prior to payload release until payload release, from payload capture to payload capture plus 40 min, and from 3 hrs prior to deorbit until deorbit. For crew sizes greater than 3, it is also on from pwr xfr int to OMS-2 and from deorbit to EOM. For crew sizes greater than 3 on a single shift or 6 on a two shift schedule, it is also on during the crew workday.
02420500 AUDIO TERM UNIT-ARLK	4	7677	415,417,419	On from 3.0 hrs prior to any scheduled EVA until 1.0 hr post EVA. For satellite refurbishment missions - on during any scheduled docking module operations
02420600 AUDIO TERM UNIT-OS	4	0077	None	Not used - Crew option on orbit
02420700 AUDIO TERM UNIT-MD #1	4	7677	101,103,109, 401,429,433	Usage is a function of crew size and shift description, as follows: Two crewmen - On during crew sleep periods Three crewmen/single shift - On during crew sleep periods Three crewmen/two shift - Not used

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Four crewmen/single shift - On during crew sleep periods Four crewmen/two shift - Not used Five crewmen/single shift - On from pwr xfr int to EOM Five crewmen/two shift - On from pwr xfr int to OMS-2 plus 1.0 hr, and from 3.0 hrs prior to deorbit to EOM Six crewmen - Same as five crewmen/two shift Seven or more crewmen - Same as five crewmen/two shift
02420800 AUDIO TERM UNIT-MD #2	4	0077	None	Not used - Crew option on orbit
02470 SPEAKER MIKE UNITS				FUNCTION: Provide simplex voice communications, broadcast paging, and C&W alarms without the use of a headset. There is one at the aft station and one in the mid-deck area. Each Speaker Mike requires an Audio Terminal Unit. USAGE: Both on with approximately 80% usage on-orbit. Off during ascent and descent.
02470100 SPKR MIKE UNIT - OS	2	7677	051,401,403, 433	ANALYSIS USAGE: On from OMS-2 to deorbit during crew workday with an 80% usage factor.

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TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO./ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02470200 SPKR MIKE UNT-MID DK	2	7677	105	On from OMS-2 to deorbit with an 80% usage factor
02480 AUDIO INTERFACE UNITS				FUNCTION: Provide an interface between crew helmets and audio terminal units. USAGE: On whenever crew are wearing helmets. ANALYSIS USAGE:
02480100 AUDIO INTF UNIT-PLT	<1	7677	None	Not used (low power)
02480200 AUDIO INTF UNIT-CMDR	<1	7677	None	Not used (low power)
02490 HEADSET INTERFACE UNITS				FUNCTION: Provide an interface between headsets and audio terminal units. USAGE: On throughout crew workday. ANALYSIS USAGE:
02490100 HDSET INTF UNIT-PLT	1	7677	None	Not used (low power)

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02490200 HDSET INTF UNIT-CMDR	1	7677	None	Not used (low power)
02491 MULTIPLE HEADSET ADAPTER				FUNCTION: TBD USAGE: On from pwr xfr int to EOM. ANALYSIS USAGE:
02491000 MULTIPLE HDSET ADPTR	1	7677	None	Not used (low power)
02500 GLOBAL POSITION SYS RECEIVERS/PROCESSORS				FUNCTION: TBD USAGE: On continuously from power xfr int to EOM when installed ANALYSIS USAGE:
02500100 GPS RCVR/PROC ASY1	80	3000	101	OFT - N/A OPS - On from power xfr int to EOM
02500200 GPS RCVR/PROC ASY 2	80	3000	101	Same as 02500100
02500300 GPS RCVR/PROC ASY 3	80	3000	101	Same as 02500100
02500400 GPS RCVR/PROC ASY 4	80	3000	101	Same as 02500100

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02510 GLOBAL POSITION SYS PREAMP ELECT ASY				FUNCTION: TBD USAGE: On continuously from power xfr int to EOM, when installed. ANALYSIS USAGE:
02510100 GPS PREAMP ELECT - UL	2	3000	101	OFT - N/A OPS - On from pwr xfr int to EOM
02510200 GPS PREAMP ELECT - LR	2	3000	101	Same as 02510100
02510300 GPS PREAMP ELECT - UC	2	3000	101	Same as 02510100
02510400 GPS PREAMP ELECT - LC	2	3000	101	Same as 02510100
02510500 GPS PREAMP ELECT - UR	2	3000	101	Same as 02510100
02510600 GPS PREAMP ELECT - LL	2	3000	101	Same as 02510100
02610 KU-BND SIG PROC ASSY				FUNCTION: Provides the interface and signal conditioning of wide band payload and operational data (digital and analog) for Ku-Band communications transmission and reception.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				On from PLB Doors open to PLB Doors close for Ku-Band operations. The unit is not required during radar operations but will remain on.
				ANALYSIS USAGE:
02610000 KU-BND SIG PROC ASSY	76	7600	435	OFT - N/A
				OPS - On from 7 min 20 sec after PLB Door open initiation to PLB Door close initiation
02630 KU BAND ELECTRONIC ASSEMBLIES				FUNCTION:
				Operate in conjunction with the Ku-Band Deploy Assembly A (see 02640) to provide a wide band communications system for data interchange with ground via the TDRS, or a rendezvous radar sensor to detect and track detached payloads during rendezvous operations.
				Assembly 1 provides all antenna controls and is used for both communications and radar operations.
				Assembly 2 is used for radar operations only and provides signal processor inputs to Assembly 1 when it is used in radar operations.
				The Standby Mode represents the power consumed with no high voltage applied to the unit.
				The Operate Motor Mode represents the power consumed by the antenna motor control logic during high speed usage (stowing, unstowing, and search) when in the

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				communications or radar mode. The Operate Nominal Mode represents the power consumed by Assembly 1 during the low speed tracking period, utilizing signal processor inputs (see 02610) or the Assembly 2 (radar signal processor). The Radar Operate Mode represents the power consumed by Assembly 2 in processing radar RF angle tracking signals to Assembly 1 for antenna control. USAGE: Standby Mode - On whenever the Ku-Band EA1 Electronics Assembly is in standby. This mode will be used for unit warmup during approximately the initial 5 minutes of operation. It may be used during some payload operations to prevent radiating into the payload. Operate Motor Mode - On whenever the Ku-Band Electronic Assemblies are in a search and acquisition activity for either communications or radar operations. Operate Nominal Mode - On whenever the Ku-Band Electronic Assemblies are in communications link lock, radar passive tracking, or radar lock operations. Radar Operate Mode - On whenever the EA2 Electronics Assembly is processing radar signal data for input to the EA1 Electronics Assembly. These times are from initiation of second phase rendezvous until after docking, and from prior to undocking until completion of the Orbiter separation maneuver. ANALYSIS USAGE: OFT - N/A
02630100 EA1-A COM/RDR OP2-MT	275	7600	435	

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On for 10 min beginning 12 min 20 sec after PLB Doors open initiation
02630110 EA1-A COM/RDR OP-NOM	130	7600	435	OFT - N/A
				OPS - On from 22 min 20 sec after PLB Doors open initiation to PLB Doors close initiation
02630120 EA1-A COM/RDR-STBY	105	7600	435	OFT - N/A
				OPS - On for 5 min beginning 7 min 20 sec after PLB Doors open initiation
02630200 KUBD EA2 RADAR-OPER	50	7600	405,409,411, 413	OFT - N/A
				OPS - On during rendezvous from 30 min prior to NCC until 10 min after docking; on from 15 min prior to undocking until the end of the separation burn
02640 KUBAND DEPLOY ASSEMBLY A				FUNCTION:
				Provides the first stage of RF reception, the final stage of RF transmission, and the antenna pointing to facilitate the functions of the Ku-Band Electronics Assemblies (see 02630).
				The Standby Mode represents the power consumed with no high voltage applied to the unit.
				The Communications Mode represents the power consumed by the antenna drive motors while performing

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				communications search and acquisition operations (see 02630100). The Radar Passive Mode represents the power consumed during low speed tracking of targets. The Radar Active Mode represents the power consumed during radar active search and acquisition operations. USAGE: Communications Mode - On for 10 min from PLB Doors open, except when Radar Mode is on, to support communications search and acquisition operations. Radar Passive Mode - On prior to second phase rendezvous and after undocking for low speed tracking of targets. Radar Active Mode - On from initiation of second phase rendezvous for active transponder search and acquisition operations. Standby Mode - On to warm up unit prior to Communications or Radar operations. ANALYSIS USAGE:
02640000 KUBD DA-A COMM-OPER	302	7600	435	OFT - N/A OPS - On for 10 min beginning 12 min 20 sec after PLB Doors open initiation
02640010 DA-A RDR OPR-PASS LR	264	7600	405,409,411, 413	OFT - N/A OPS - On during rendezvous from 20 min prior to NCC

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				until 10 min after docking; on from 15 min prior to undocking until the end of the separation burn
02640020 DA-A RDR OPR-ACT SR	246	7600	409	OFT - N/A OPS - On during rendezvous from 30 min prior to NCC until 20 min prior to NCC
02640030 DA-A COM/RDR-STBY	129	7600	435	OFT - N/A OPS - On for 5 min beginning 7 min 20 sec after PLB Doors open initiation
02810 TV CAM HTRS				FUNCTION: Provide thermal protection for payload bay mounted TV cameras. USAGE: Thermostatically controlled. Duty cycles are a function of attitude and beta angle. No usage is expected during ascent; they will be disabled during descent. Note: In general, a heater will be on at some duty cycle when its associated TV camera is off. It is estimated that one watt of heating will be required for each watt of operating power. ANALYSIS USAGE: See appendix B
02810100 TV CAM HTR-FWD PLB	20	7677	600 series	
02810200				

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
TV CAM HTR-AFT PLB	20	7677	600 series	See appendix B
02810300 TV CAM HT-LRMS WRS	20	7637	600 series	See appendix B
02810400 TV CAM HT-LRMS ELB	20	7637	600 series	See appendix B
02810500 TV CAM HTR-KEEL BAY	20	7677	600 series	See appendix B
02820 PAN TILT ASSY HTRS				FUNCTION: Provide thermal protection for the pan tilt assemblies. USAGE: Thermostatically controlled. Duty cycles are a function of attitude and beta angle. No usage is expected during ascent; they will be disabled for descent. Note: In general, a heater will be on at some duty cycle when its associated Pan Tilt Assembly is off. It is estimated that one watt of heating will be required for each watt of operating power. ANALYSIS USAGE:
02820100 PAN TLT HTR-FWD BAY	8	7677	600 series	See appendix B
02820200 PAN TLT HTR-AFT BAY	8	7677	600 series	See appendix B
02820300 PAN TLT HTR-KEEL BAY	8	7677	600 series	See appendix B

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02820400 PAN TLT HT-LRMS ELB	8	7637	600 series	See appendix B
02850 KUBD DP ASSY CBL HT				FUNCTION: Maintains the coax cable temperature above -65 deg F, to permit the cable to flex when the boom comes up. USAGE: Estimates are that the heater will be required to be on just prior to opening and just prior to closing the PLB Doors. ANALYSIS USAGE: OFT - N/A OPS - On with a 50% usage factor from insertion to PLB Door open initiation and from 30 min prior to until 5 sec following PLB Door close initiation
02850000 KUBD DP ASY A CBL HT	25	7600	437,457	
02860 KUBD DEPLOY A HTRS				FUNCTION: Provide thermal protection for the Ku-Band Comm A deployed assemblies. USAGE: The mechanical assembly heaters will operate as a function of attitude and beta angle. Estimates are that the electronic assembly heater usage will be approximately zero when the Ku-Band system is operated in accordance with the nominal timeline.

TABLE A-II.- COMMUNICATIONS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
02860100 KUBD DPLY A DEA HTR1	176	7600	None	Not used (contingency equipment)
02860200 KUBD DPLY A DEA HTR2	176	7600	None	Not used (contingency equipment)
02860300 KUBD DPLY A DMA HTR	231	7600	600 series	OFT - N/A OPS - See appendix B
02870 GLOBAL POS SYS PRE-AMP HEATERS				FUNCTION: Provides proper thermal environment for the GPS preamp electronic assemblies when assemblies are not on USAGE: Used prelaunch prior to time GPS is turned on
				ANALYSIS USAGE:
02870100 GPS PREAMP HTR - UL	10	3000	None	Not used (GSE usage)
02870200 GPS PREAMP HTR - LR	10	3000	None	Same as 02870100
02870300 GPS PREAMP HTR - UC	10	3000	None	Same as 02870100
02870400 GPS PREAMP HTR - LC	10	3000	None	Same as 02870100

TABLE A-II.- COMMUNICATIONS SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCK	FUNCTION & USAGE
02870500 GPS PREAMP HTR - UR	10	3000	None	Same as 02870100
02870600 GPS PREAMP HTR - LL	10	3000	None	Same as 02870100

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DISP & CONT

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03010 ATTITUDE DIR INDS				FUNCTION: Display attitude reference, error, rate and rate error. Each ADI receives power and processed signals from a specific DDU. A DDU will, therefore, be on whenever its associated ADI is on (ref. 03220). USAGE: The left forward unit will probably be on continuously throughout all missions during the crew workday. The right forward unit will be on from prelaunch through OMS-2, and from approximately 3.0 hrs prior to deorbit through stoproll. It will also be on for on-orbit OMS and RCS maneuvers performed at the forward station, as may the aft unit. Two units are required to be on for EVA's, and three when working in close proximity to another vehicle (i.e. stationkeeping, docking, undocking, etc.), during second phase rendezvous (post NCC), and during payload handling. In addition, each ADI will generally be on whenever its related DDU is on. ANALYSIS USAGE:
03010100 ADI#1-FWD LH	17	7677	051,103,109, 401,403,433	On from pwr xfr int through orbital configuration, during the crew workday, and from start of deorbit preps through EOM
03010200 ADI#2-FWD RH	17	7767	051,055,103, 111,303,307, 401,405,409, 411,413,433, 451,453,463, 505	STS-1 - On from pwr xfr int until 3.0 hrs after OMS-2, and from 30 min prior to on-orbit OMS burns, and RCS burns performed at the forward station, through the post burn powerdown; on from 5 min prior to the on-orbit aerosurface deflection checks through the checkout period, from 6.0 hrs prior to until 1.0 hr after the rehearsal deorbit, and from 6.0 hrs prior

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				to deorbit until 6 min 30 sec after stoproll. STS-2 - Same as STS-1 except also used throughout RMS checkout activities. OPS - On from pwr xfr int until 30 min after OMS-2, and from 30 min prior to on-orbit OMS burns, and RCS burns performed at the forward station, through the post burn powerdown; on from 1.0 hrs prior to NCC until the initiation of stationkeeping; on for stationkeeping, docking, undocking, and payload handling activities thru the end of those activities; on from 5 min prior to the onorbit aerosurface deflection checks through the checkout period, and from 3.0 hrs prior to deorbit until 6 min 30 sec after stoproll
03010300 ADI#3-AFT	17	7677	051,055,107, 305,401,405, 409,411,413, 417,419,433, 451,453	STS-1 - On from 1.0 hrs after OMS-2 until 10 min after rehearsal deorbit prep, on 45 min after deorbit rehearsal reconfiguration until 10 min after entry day deorbit prep STS-2 - On from 1.0 hr after OMS-2 until 10 min after deorbit prep; on for the duration of the RMS checkout activities. OPS - On from 30 min prior to aft RCS burns through the post burn powerdown; from 1.0 hrs prior to NCC until the initialization of stationkeeping; for stationkeeping, docking, undocking, and payload handling activities through the end of those activities; and from 15 min prior to until 15 min post EVA
03020 HORZ SITUATION INDS				FUNCTION:

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Display desired course, course deviation, heading, range and bearing, and glide slope deviation. Units are crew selectable to be driven by TACAN (170,000 ft), MSBLS (12,000 ft), or GNC Computer state vector (throughout entry). **USAGE:** Both on from prelaunch through OMS-2 and from approximately 3.0 hrs prior to deorbit through stoproll. Note: 1). HSI #1 receives power via the LH Instrument Power switch. This switch, when in the FLT position, supplies power to HSI #1, AMI #1, AVVI #1, and the SPI. When in the FLT/MPS position it also provides power to the MPS Tape Meters. On-time is, therefore, a composite of the requirements of these instruments (refs. 03030, 03040,03050, 03060, 03070, and 03130). 2). HSI #2 receives power via the RH Instrument Power switch, which also supplies power to AMI #2, AVVI #2, and the APU/HYD Tape Meters. On-time is, therefore, a composite of the requirements of these instruments (refs. 03030, 03040, 03050,03060, and 03070). **ANALYSIS USAGE:**
03020100 HSI #1	27	7677	051,103,111 401,433,505	STS-1 - On from pwr xfr int until 2 hrs 40 min after OMS-2, from 6.0 hrs prior to until 1.0 hrs after the rehearsal deorbit, and from 6.0 hrs prior to deorbit until 6 min 30 sec after stoproll STS-2 - On from pwr xfr int until 2 hrs 40 min after OMS-2, and from 6.0 hrs prior to deorbit

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				until 6 min 30 sec after stoproll. OPS - On from pwr xfr int until 30 min after OMS-2 and from 3.0 hrs prior to deorbit until 6 min 30 sec after stoproll
03020200 HSI #2	27	7677	051,103,109, 401,433,463	STS-1 - On from pwr xfr int until 2 hrs 40 min after OMS-2, from 6.0 hrs prior to until 1.0 hrs after the rehearsal deorbit, from 30 min prior to the onorbit FCS checkout through the checkout period, and from 6.0 hrs prior to deorbit through EOM STS-2 - On from pwr xfr int until 2 hrs 40 min after OMS-2, from 30 min prior to the onorbit FCS checkout through the checkout period, and from 6 hrs prior to deorbit through EOM OPS - On from pwr xfr int until 30 min after OMS-2, from 30 min prior to the onorbit FCS checkout through the checkout period, and from 3.0 hrs prior to deorbit through EOM
03030 ALPHA MACH INDS				FUNCTION: Display angle of attack, acceleration, mach number, and equivalent air speed. The units are driven by the computer state vector or through the computers, by the air data probes. USAGE: Both on from prelaunch through OMS-2 and from approximately 3.0 hrs prior to deorbit through stoproll (see note 03020).

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
03030100 AMI #1	7	7677	051,103,111, 401,433,505	Same as 03020100
03030200 AMI #2	7	7677	051,103,109 401,433,463	Same as 03020200
03040 ALPHA/MACH EL UNITS				FUNCTION: Operate in conjunction with the AMI's to display angle of attack, acceleration, mach number, and equivalent air speed. USAGE: Both on from prelaunch through OMS-2 and from approximately 3.0 hrs prior to decrbit through stoproll (see note 03020).
				ANALYSIS USAGE:
03040100 ALPHA MACH EL UNIT 1	31	7677	051,103,111, 401,433,505	Same as 03020100
03040200 ALPHA MACH EL UNIT 2	31	7677	051,103,109 401,433,463	Same as 03020200
03050 ALT VERT VEL INDS				FUNCTION: Display inertial or air data altitude, radar altimeter altitude, altitude rate, and altitude acceleration. Each indicator has two altitude scales. One is driven

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				by the radar altimeter. The other is driven by the computer nav state and/or the air data probes. USAGE: Both on from prelaunch through OMS-2 and from approximately 3.0 hrs prior to deorbit through stoproll (see note 03020). ANALYSIS USAGE:
03050100 AVVI #1	7	7677	051,103,111, 401,433,505	Same as 03020100
03050200 AVVI #2	7	7677	051,103,109, 401,433,463	Same as 03020200
03060 ALT VER VEL EL UNITS				FUNCTION: Operate in conjunction with AVVI's to display inertial or air data altitude, radar altimeter altitude, altitude rate, and altitude acceleration. USAGE: Both on from prelaunch through OMS-2 and from approximately 3.0 hrs prior to deorbit through stoproll (see note 03020). ANALYSIS USAGE:
03060100 ALT VER VEL EL UN #1	25	7677	051,103,111, 401,433,505	Same as 03020100

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03060200 ALT VER VEL EL UN #2	25	7677	051,103,109, 401,433,463	Same as 03020200
03070 TAPE METERS				FUNCTION: Display MPS pressures, and APU/Hydraulic pressures, temperatures, and quantities. USAGE: The MPS meters are required to be on from prelaunch through OMS-2. The APU oil and APU/HYD meters are required to be on from prelaunch through OMS-2 and from the start of pre-deorbit FCS checkout until EOM (see note 03020). In addition, they will be powered up daily on-orbit, for 5 to 10 min, for an APU/HYD thermal check. The Active Mode is defined to be that period when under max rate motion, as when first turned on. The Static Mode is defined as that period when monitoring a system parameter, whether the parameter is increasing, decreasing, or constant. ANALYSIS USAGE:
3070100 MPS TAPE MTR M1-ACT	11	7677	None	Not Used. (Usage TBD)
03070110 MPS TAPE MTR M1-STAT	7	7677	103,401	STS-1 - On from pwr xfr int until 2 hrs 40 min after OMS-2 STS-2 - Same as STS-1 OPS - On from pwr xfr int until 30 min after OMS-2

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03070200 MPS TAPE MTR M2-ACT	7	7677	None	Same as 03070100
03070210 MPS TAPE MTR M2-STAT	5	7677	103,401	Same as 03070110
03070300 MPS TAPE MTR M3-ACT	15	7677	None	Same as 03070100
03070310 MPS TAPE MTR M3-STAT	10	7677	103,401	Same as 03070110
03070500 HYD TAPE MTR M1-ACT	11	7677	None	Same as 03070100
03070510 HYD TAPE MTR M1-STAT	7	7677	051,103,109, 401,433,463	Same as 03020200
03070600 HYD TAPE MTR M2-ACT	11	7677	None	Same as 03070100
03070610 HYD TAPE MTR M2-STAT	7	7677	051,103,109, 401,433,463	Same as 03020200
03070700 APU TAPE MTR M3-ACT	11	7677	None	Same as 03070100
03070710 APU TAPE MTR M3-STAT	7	7677	051,103,109, 401,433,463	Same as 03020200
03070800 APU TAPE MTR M4-ACT	7	7677	None	Same as 03070100

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03070810 APU TAPE MTR M4-STAT	5	7677	051,103,109, 401,433,463	Same as 03020200
03100 KU-BD COMM/RDR IND				FUNCTION: Displays the range and range rate for the radar, and the pointing angles of ku-band antenna. This indicator is on panel A2. USAGE: The indicator will be on when working in close proximity to another vehicle (i.e. stationkeeping, docking, during second phase rendezvous and during payload handling), and during Ku-Band communications transmission and reception. ANALYSIS USAGE:
03100000 KU-BD COMM/RDR IND	15	7617	405,409,411, 451,453	STS-1 - Not used STS-2 - Not used OPS - On from 1.0 hrs prior to NCC until the initiation of stationkeeping, docking, and payload handling activities through the end of these activities
03120 CROSS POINTER IND				FUNCTION: Displays line-of-sight rates of the rendezvous radar antenna. USAGE:

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				On during the later phases of rendezvous. This component functions only when the rendezvous radar is operating.
				ANALYSIS USAGE:
03120000 CROSS POINTER IND	3	7677	409	On during rendezvous from 1.0 hrs prior to NCC until initiation of stationkeeping
03130 SURF POSITION IND				FUNCTION:
				Displays the elevon (4), aileron, body flap, rudder, and speed brake positions, and the commanded position of the speed brake. These indicators are meters on panel F7.
				USAGE:
				On from prelaunch through OMS-2 to support RTLS or AOA aborts. On from start of deorbit checkout to stoproll (see note 03020).
				ANALYSIS USAGE:
03130000 SPI	17	7677	051,103,111, 401,433,505	Same as 03020100
03140 OMS/RCS PROP QTY IND				FUNCTION:
				Displays percent fuel and oxidizer remaining via digital readouts. The readouts are switch selectable for left, right, or fwd RCS; lowest RCS tank (fuel or oxidizer) for left, right, or fwd RCS; and left, right, or kitted OMS. There is no on/off control.

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				On continuously throughout all missions.
				ANALYSIS USAGE:
03140000 OMS/RCS PROP QTY IND	5	7677	101	On from pwr xfr int to EOM
03150 C&W POWER SUPPLIES- STBY				FUNCTION:
				Provide power for the unit that monitors caution and warning parameters. C&W parameters may be selected, then enabled or disabled. The unit continues to track disabled parameters, but outputs no signals. The unit is a small GPC which performs only C&W functions. It is backed up by the systems management software.
				USAGE:
				On continuously throughout all missions.
				Note: The unit can be operated in a powered down configuration during contingencies. In this configuration power is provided only to the backup tone generator.
				ANALYSIS USAGE:
03150100 C&W PWR SUP A-STBY	21	7677	101	On from pwr xfr int to EOM
03150200 C&W PWR SUP B-STBY	14	7677	101	On from pwr xfr int to EOM
03170				

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
MISSION TIMERS				FUNCTION: Display the output of the master timing unit. There are two units, one located at the forward station and one at the aft station. The units are switch selectable to display either GMT or MET. USAGE: It is estimated that the forward timer will be on continuously throughout all missions. The aft timer will also be on continuously for OFT missions and will be turned on for RCS burns performed at the aft station, when in the proximity of another vehicle, for payload handling operations, and for 2nd phase rendezvous operations. ANALYSIS USAGE:
03170100 MISSION TIMER #1 FWD	4	7677	101	On from pwr xfr int until EOM
03170200 MISSION TIMER #2 AFT	4	7677	101,305,401, 405,409,411, 413,433,451, 453	OFT - On from pwr xfr int until EOM OPS - On from OMS-2 plus 30 min to OMS-2 plus 1.0 hrs; on from 30 min prior to RCS burns performed at the aft station through the post burn powerdown; on from 1.0 hrs prior to NCC until the initiation of stationkeeping; on for stationkeeping, docking, undocking, and payload handling activities through the end of those activities; on for 30 min beginning 2.0 hrs after initiation of deorbit prep activities.
03180 EVENT TIMERS				FUNCTION: Display time in minutes and seconds. There are two

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				units, one located at the forward station and one at the aft station. The units have off/test, start/stop. count-up/count-down, and set/reset controls. In addition, the initial time may be set with thumbwheels. USAGE: Both units will be on continuously throughout all OFT flights. For OPS, estimations are that the forward event timer will be on from prelaunch through OMS-2; during rendezvous; from approximately 30 min prior to on-orbit OMS burns, and RCS burns performed at the forward station, through those activities; from about 15 min prior to IMU alignments through those activities; approximately 20% of the time during the crew workday; and from about 3.0 hrs prior to deorbit until EOM. It is estimated that the aft timer will be on during the latter phase of rendezvous (post NCC) and from about 30 min prior to RCS burns performed at the aft station through the burn periods. It is further estimated that both units will be on from approximately 30 min prior to docking, undocking, stationkeeping, payload handling activities through those activities. ANALYSIS USAGE:
03180100 EVENT TIMER #1 FWD	3	7677	101,103,109, 303,307,401, 403,405,407, 409,411,413, 433,451,453	OFT - On from pwr xfr int until EOM OPS - On from pwr xfr int until 30 min after OMS-2; from 1.0 hrs prior to NCC until initiation of stationkeeping; from 30 min prior to scheduled on-orbit OMS burns, and forward RCS burns, through the post burn powerdown; for 45 min beginning 15 min prior to scheduled IMU alignments; for stationkeeping, docking, undocking, and payload handling operations through those activities; and from 3.0 hrs prior to deorbit until EOM. On with a 20%

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				usage factor during the crew workday
03180200 EVENT TIMER #2 AFT	3	7677	101,305,401, 405,409,411, 413,433,451, 453	OFT - On from pwr xfr int until EOM. OPS - On from OMS-2 plus 30 min until OMS-2 plus 1.0 hrs; from 1.0 hrs prior to NCC until the initiation of stationkeeping; from 30 min prior to scheduled aft RCS burns through the post burn powerdown; for stationkeeping, docking, undocking, and payload handling operations through those activities; and for 2.5 hrs during deorbit prep activities
03220 DISP DRVR UNITS				FUNCTION: Provide ac and dc power to the controllers (i.e. RHC, RPTA, SBTC, and THC) and indicator power to the ADI. In addition, the units receive and decode the DPS signals which drive the primary flight displays (i.e. ADI, AMI, AVVI, and HSI). Each DDU contains multiple power supplies, three of which supply triple redundant power to the controllers, one of which supplies power to an ADI, and one of which provides power to the internal DDU electronics. Separate on/off control is provided for controller power. ADI and internal DDU power can, therefore, be applied exclusive of controller power. USAGE: It is estimated that the left forward unit will be on continuously throughout all missions and that an additional forward unit will be on for ascent, descent, on-orbit OMS burns, and for RCS burns performed at the forward station. Estimations are that

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				the aft unit will be on for RCS burns performed at the aft station, and that all three units will be on during the latter phase of rendezvous (post NCC), and during stationkeeping, docking, undocking, and payload handling activities. Note: 1). The Fwd LH DDU provides power to the LH ADI, RHC, RPTA, SBTC, and THC. In addition, it decodes signals for the LH ADI and AMI #1, AVVI #1, and HSI #1. The on-time of this unit is, therefore, a composite of the requirements of this equipment. 2). The Fwd RH DDU provides power to the RH ADI, RHC, RPTA, and SBTC. In addition, it decodes signals for the RH ADI and AMI #2, AVVI #2, and HSI #2. The on-time of this unit is, therefore, a composite of the requirements of this equipment. 3). The Aft DDU provides power to the Aft ADI, RHC, and THC. In addition, it decodes signals to the Aft ADI. The on-time of this unit is, therefore, a composite of the requirements of this equipment.
				ANALYSIS USAGE:
03220100 DDU #1 FWD LH	120	7677	051,103,109, 401,403,433	On from pwr xfr int through orbital configuration, during the crew workday and from start of deorbit preps through EOM
03220200 DDU #2 FWD RH	120	7677	051,055,103, 111,303,307, 401,405,409, 411,413,433,	STS -1 - On from pwr xfr int until 3.0 hrs after OMS-2; from 30 min prior to on-orbit OMS and Fwd RCS burns through the post burn powerdown; from 5 min prior to onorbit aerosurface deflection checks

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			451,453,463, 505	through the checkout period; from 6.0 hrs prior to until 1.0 hrs after the rehearsal deorbit; and from 6.0 hrs prior to deorbit until 6 min 30 sec after stoproll STS-2 - On from pwr xfr int until 3.0 hrs after OMS-2; from 30 min prior to onorbit OMS and Fwd RCS burn through the post burn powerdown; from 5 min prior to the onorbit FCS checkout through the checkout period; from 6 hrs prior to deorbit until 6 min 30 sec after stoproll; and throughout the RMS checkout activities. OPS - On from pwr xfr int until 30 min after OMS--2, from 30 min prior to on-orbit OMS and Fwd RCS burns through the post burn powerdown; from 1.0 hrs prior to NCC until stationkeeping; for stationkeeping, docking, undocking, and payload handling activities through the end of those activities; from 5 min prior to onorbit aerosurface deflection checks through the checkout period; and from 3.0 hrs prior to de-orbit until 6 min 30 sec after stoproll
03220300 DDU #3 AFT	120	7677	051,055,107, 305,401,405, 409,411,413, 417,419,433, 451,453	STS-1 - On from 1 hr after OMS-2 until 10 min after rehearsal deorbit prep, on 45 min after deorbit rehearsal reconfiguration until 10 min after entry day deorbit prep STS-2 - On from 1 hr after OMS-2 until 10 min after deorbit prep; and throughout the RMS checkout activities. OPS - On from 30 min prior to Aft RCS burns through post burn powerdown; from 1.0 hrs prior to NCC until stationkeeping; for stationkeeping,

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				docking, undocking, and payload handling activities through the end of those activities; and from 15 min prior to until 15 min post EVA
03270 CRT DISPLAY UNITS				FUNCTION: Display information to the crew for GNC, systems management, and payload operations. Each display unit is driven by its associated DEU and is controlled through that DEU by means of a manual entry keyboard. A display unit can display information from only one computer at a time. The display units require approximately 30 sec warmup when switched from off to on and are essentially instant-on when switched from standby to on. USAGE: The CRT display units are used at crew discretion. Estimations are that the three forward units will be on from prelaunch through orbital reconfiguration; for on-orbit OMS burns, and RCS burns performed at the forward station; during rendezvous operations; for the onorbit FCS checkout; and from the start of deorbit prep until aproximately 10 min after stoproll. Estimations are that two forward display units will be on during the crew workday, and that the aft unit will be in standby during crew sleep periods. It is further estimated that the aft unit will be on in support of specific activities performed at the aft station (i.e. opening/closing the payload bay doors, RCS burns, latter phase of rendezvous, COAS operations, payload handling, RMS checkout and when operating in close proximity to another vehicle), and that, with crew sizes of three, or more, it will be on during ascent and descent to support

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				payload C&W requirements.
				ANALYSIS USAGE:
03270100 CRT DU #1 -LF	90	7677	051,103,109, 401,403,433	STS-1 - On during crew awake periods from pwr xfr int until EOM STS-2 - Same as STS-1 OPS - On from pwr xfr int until 1.0 hrs after OMS-2, during the crew workday, and from the start of deorbit preps until EOM
03270110 CRT DU #1 - LF STDBY	20	7677	None	Not used
03270200 CRT DU #2 - RF	90	7677	051,103,109, 303,307,401, 409,433,463	STS-1 - On from pwr xfr int until OMS-2 plus 20 min, from 5 hrs before until 2 hrs after deorbit rehearsal, on from 30 min prior to the onorbit FCS checkout until completion of checkout, and from 5 hrs before deorbit until EOM STS-2 - On from pwr xfr int until OMS-2 plus 20 min, from 30 min prior to the onorbit FCS checkout until completion of the checkout, and from 5 hrs prior to deorbit until EOM. OPS - On from pwr xfr int until 1 hr after OMS-2; from 1.0 hrs prior to NCC until initiation of stationkeeping from 30 min prior to on-orbit OMS, and forward RCS burns, through the post burn powerdown; from 30 min prior to the onorbit aerosurface deflection checks through the checkout period, and from 3.0 hrs prior to deorbit until EOM
03270210				

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
CRT DU #2 - RF STDBY	20	7677	None	Not used
03270300 CRT DU #3 - CF	90	7677	051,103,109, 401,403,433	STS-1 - On during crew awake periods from pwr xfr int to EOM STS-2 - Same as STS-1 OPS - On from pwr xfr int until 1.0 hrs after OMS-2, during the crew workday, and from the start of deorbit preps until EOM
03270310 CRT DU #3 - CF STDBY	20	7677	None	Not used
03270400 CRT DU #4 -MSS	90	7677	055,103,109, 305,401,405, 409,411,413, 433,435,437, 451,453	STS-1 - On from OMS-2 plus 20 min to OMS-2 plus 3 hrs, from 2 hrs prior to until 1 hr prior to deorbit day rehearsal, from 2 hrs prior to until 1 hr prior to deorbit on entry day STS-2 - On from OMS-2 plus 20 min to OMS-2 plus 3 hrs; from 2 hrs prior to deorbit TIG until 1 hr prior to deorbit TIG; and throughout the RMS checkout activities. OPS - On from 30 min prior to until 30 min after initiation of the PLB doors open and close sequences; and from 30 min prior to scheduled RCS burns, performed at the aft station, through the post burn powerdown; during rendezvous from 1.0 hrs prior to NCC until initiation of stationkeeping; and for stationkeeping, docking, undocking, and payload handling through those activities. For crew sizes of 3, or more - on from pwr xfr int until 1.0 hrs after OMS-2 and from 1.0 hrs prior to deorbit until EOM

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03270410 CRT DU #4 - MSS STBY	20	7677	429	On during each crew sleep period
03280 DISPLAY ELEC UNITS				FUNCTION: Each unit accepts signals from a manual entry keyboard, communicates with a GPC, and provides the signals which drive a CRT Display Unit. A DEU stores and processes the selected fixed format information (background); and requests, accepts, and processes the variable data (foreground), which drives its respective CRT DU. Each DEU operates in conjunction with a specific CRT DU, and with one keyboard and one GPC at a time. USAGE: Each DEU operates in conjunction with its associated CRT Display Unit (ref. 03270). The DEU's require no standby power. ANALYSIS USAGE:
03280100 DEU #1	202	7677	051,103,109, 401,403,433	Same as 03270100
03280200 DEU #2	202	7677	051,103,109, 303,307,401, 409,433,463	Same as 03270200
03280300 DEU #3	202	7677	051,103,109, 401,403,433	Same as 03270300
03280400 DEU #4	202	7677	055,103,109,	Same as 03270400

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			305,401,405, 409,411,413, 433,435,437, 451,453	
03310 PANEL LIGHTS				FUNCTION: Used in conjunction with the console floodlights to illuminate the main instrument panel nomenclature. Panel lighting is prime when crew night vision must be maintained, but low level floodlighting is necessary to provide a structural reference. The panel lights have high/low control, with continuous dimming control in the low position. USAGE: Panel lighting is a function of crew activities and is at crew discretion. Estimates are as follows: Left/Center Panel Lights - On from prelaunch through orbital reconfiguration, on-orbit during the crew workday, and from the start of deorbit prep through EOM. Right and Left Overhead Panel Lights - Same as Left/Center Panel lights. Right Panel Lights - On from prelaunch through orbital reconfiguration, from approximately 30 min prior to OMS burns and RCS burns performed at the forward station through the post burn powerdown, during stationkeeping, docking, undocking, and payload handling, during the latter phase of rendezvous (post NCC), for the onorbit FCS checkout, and from approximately 3.0 hrs prior to deorbit until EOM. In addition, they will be turned on for approximately 20 min per day

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				for on-orbit EPS/ECLSS checks. MS Panel Lights - On during the PLB doors open and close sequences, during the latter phase of rendezvous (post NCC), during EVA, stationkeeping, docking, undocking, and payload handling activities, and from approximately 30 min prior to RCS burns performed at the aft station through the post burn powerdown. OS Panel Lights - On during the PLB doors open and close sequences, during the latter phase of rendezvous (post NCC), during EVA, stationkeeping, docking, undocking, and payload handling activities, and from approximately 30 min prior to RCS burns performed at the aft station through the post burn powerdown. OS Panel Lights - Same as MS Panel Lights Note: 1). The low power level is estimated to be approximately 67% of the high power level. 2). In general, if the floodlight intensity is raised (e.g. due to larger crew size, mission activities, etc.) the panel lighting intensity must also be raised. **ANALYSIS USAGE:**
03310100 PANEL LTS - LEFT/CTR	195	7677	051,103,109, 401,403,433	OFT - On with a 100% usage factor from pwr xfr int until 3 hrs after OMS-2; on with a 67% usage factor during the crew workday, and on with a 100% usage from the start of deorbit prep through EOM OPS - On with a 100% usage factor from pwr xfr int until 1.0 hr after OMS-2, on with a 67% usage factor during the crew workday, and on with a 100% usage factor from the start of deorbit preps through EOM

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03310200 PANEL LTS - LFT/OVHD	177	7677	051,103,109, 401,403,433	Same as 03310100
03310300 PANEL LIGHTS - RIGHT	133	7677	055,103,109, 303,307,401, 403,405,409, 411,413,433, 451,453	OFT - On with a 100% usage factor from pwr xfr int until 3 hrs after OMS-2 cutoff; then on with a 67% usage factor during the crew workday and from 30 min prior to scheduled OMS burns and RCS burns performed at the forward station through the post burn powerdown; on with 100% usage factor throughout any RMS checkout activities, and from 6 hrs prior to deorbit through EOM. OPS - On with a 100% usage factor from pwr xfr int until 1 hr after OMS-2 cutoff; then on with a 67% usage factor during the crew workday, during rendezvous from 1.0 hrs prior to NCC until initiation of stationkeeping, from 30 min prior to scheduled OMS burns and RCS burns performed at the forward station through the post burn powerdown, for stationkeeping, docking, undocking, and payload handling operations through those activities; on with 100% usage factor from 3 hrs prior to deorbit through EOM
03310400 PANEL LIGHTS - MS	25	7677	001,003,005, 055,305,405, 409,411,413, 417,419,435, 437,451,453, 455	OFT - Same as OPS except also on with a 67% usage factor during FTR's 151-1, 151-2, and 151-3 (STS-1 usage) and on with 100% usage factor during RMS checkout activities (STS-2 usage). OPS - On with a 67% usage factor from 30 min prior to until 30 min after initiation of the PLB doors open and close sequences, during rendezvous, from 1.0 hrs prior to NCC until initiation of station-keeping, from 30 min prior to scheduled RCS burns

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				performed at the aft station through the post burn powerdown, from 30 min prior to until 30 min post EVA, for stationkeeping, docking, undocking, payload operations and payload handling through those activities
03310500 PANEL LIGHTS - OS/PS	238	7677	001,003,005, 055,305,405, 409,411,413, 414,419,435, 437,451,453, 455	OFT - Same as OPS except also on with a 67% usage factor during FTR's 151-1, 151-2, and 151-3 (STS-1 usage) and on with a 100% usage factor during RMS checkout activities (STS-2 usage). OPS - On with a 67% usage factor from 30 min prior to until 30 min after initiation of the PLB doors open and close sequences, during rendezvous, from 1.0 hrs prior to NCC until initiation of station-keeping, from 30 min prior to scheduled RCS burns performed at the aft station through the post burn powerdown, from 30 min prior to until 30 min post EVA, for stationkeeping, docking, undocking, payload operations, and payload handling through those activities
03310700 PANEL LTS - RHT/OVHD	132	7677	051,103,109, 401,403,433	Same as 03310100
03320 INSTRUMENTS LIGHTS				FUNCTION: Provide internal illumination of dedicated displays. The instrument lights have continuous dimming control. USAGE: Instrument lighting is a function of crew activities and is at crew discretion. Estimates are as follows:

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Left/Center Instrument Lights - On from prelaunch through orbital reconfiguration, on-orbit during the crew workday, and from the start of deorbit preps through EOM. Overhead Instrument Lights - Same as Left/Center Instrument Lights. Right Instrument Lights - On from prelaunch through orbital reconfiguration; from approximately 30 min prior to OMS burns, and RCS burns performed at the forward station, through the post burn powerdown; during stationkeeping, docking, undocking, and payload handling; during the latter phase of rendezvous (post NCC); for the onorbit FCS checkout; and from approximately 3.0 hrs prior to deorbit until EOM. OS Instrument Lights - On during the PLB doors open and close sequences; during the latter phase of rendezvous (post NCC); during EVA, stationkeeping, docking, undocking and payload handling activities; and from approximately 30 min prior to RCS burns performed at the aft station through the burn. **ANALYSIS USAGE:**
03320100 INSTR LTS - LEFT/CTR	58	7677	051,103,109, 401,403,433	OFT - On with a 100% usage factor from pwr xfr int until 3.0 hrs after OMS-2, on with a 67% usage factor during the crew workday, and a 100% usage factor from 6.0 hrs prior to deorbit until EOM OPS - On with a 100% usage factor from pwr xfr int until 1.0 hrs after OMS-2, on with a 67% usage factor during the crew workday, and a 100% usage factor from 3.0 hrs prior to deorbit until EOM

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03320200 INSTR LTS - OVERHEAD	27	7677	051,103,109, 401,403,433	Same as 03320100
03320300 INSTR LTS - RIGHT	50	7677	051,055,103, 109,303,307, 401,405,409, 411,413,433, 451,453	OFT - On with a 100% usage factor from pwr xfr int until 3.0 hrs after OMS-2; from 30 min prior to scheduled OMS burns, and RCS burns performed at the forward station, through the post burn powerdown; throughout the RMS checkout activities; from 6.0 hrs prior to until 1.0 hrs after the rehearsal deorbit; and from 6.0 hrs prior to deorbit until EOM with a 100% usage factor OPS - On with a 100% usage factor from pwr xfr int until 1.0 hrs after OMS-2; during rendezvous, from 1.0 hrs prior to NCC until initiation of stationkeeping; from 30 min prior to scheduled OMS burns, and RCS burns performed at the forward station, through the post burn powerdown; for stationkeeping, docking, undocking, and payload handling operations through those activities; and from 3.0 hrs prior to deorbit until EOM at a 100% usage factor
03320400 INSTR LTS - OS	13	7677	001,003,005, 055,305,405, 409,411,413, 417,419,435, 437,451,453, 455	OFT - Same as OPS except also on during FTR's 151-1, 151-2, and 151-3 (STS-1 usage), and RMS checkout activities on STS-2. OPS - On from 30 min prior to until 30 min after initiation of the PLB doors open and close sequences; during rendezvous, from 1.0 hrs prior to NCC until initiation of stationkeeping; from 30 min prior to scheduled RCS burns, performed at the aft station, through the post burn powerdown; from 30 min prior to until 30 min post EVA; and for stationkeeping, docking, undocking, payload operations and payload

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				handling through those activities
03330 NUMERIC LIGHTS				FUNCTION: Provide illumination for the numeric displays. USAGE: Numeric lighting is a function of crew activities and is at crew discretion. Estimates are as follows: Forward Numeric Lights - On continuously throughout all missions. OS Numeric Lights - On during the PLB doors open and close sequences; during the latter phase of rendezvous (post NCC); during EVA, stationkeeping, docking, undocking, and payload handling activities; and from approximately 30 min prior to RCS burns performed at the aft station through the burn. ANALYSIS USAGE:
03330100 NUMERIC LIGHTS - FWD	17	7677	101	On from pwr xfr int to EOM
03330200 NUMERIC LIGHTS - OS	20	7677	001,003,005, 055,305,405, 409,411,413, 417,419,435, 437,451,453, 455	OFT - Same as OPS except also on during FTR's 151-1, 151-2, and 151-3 (STS-1 usage), and throughout RMS checkout activities on STS-2. OPS - On from 30 min prior to until 30 min after initiation of the PLB doors open and close sequences; during rendezvous, from 1.0 hrs prior to NCC until initiation of stationkeeping; from 30 min prior to scheduled RCS burns, performed at the aft station, through the post burn powerdown; from 30 min prior

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				to until 30 min post EVA; and for stationkeeping, docking, undocking, payload operations, and payload handling through those activities
03350 MID DECK FLOOD LTS				FUNCTION: Provide general illumination in the mid-deck area. USAGE: Mid-deck floodlights are used at crew discretion. It is estimated that, in general, all mid-deck flood lights will be on when any crewman is in the mid-deck area. In addition, three or four lights will be on during ascent and descent with crew sizes greater than four. Note: 1.) Mid-deck floodlight 5 will not be installed until DFI is removed. 2.) Mid-deck floodlights 6 through 8 will be used to provide emergency illumination. ANALYSIS USAGE:
03350100 MID DK FLDLT #1	16	7677	103,109,401, 403,423,433	ALL - Usage is a function of crew size, as follows: Two crewmen - On 10% of the time during the crew workday; on for 1.5 hrs starting 30 min prior to each scheduled eat period Three crewmen/single shift - On 15% of the time during the crew workday; on for 1.5 hrs starting 30 min prior to each scheduled eat period Three crewmen/two shift - On 10% of the time from

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on for 1.5 hrs starting 30 min prior to each scheduled eat period Four crewmen/single shift - On 20% of the time during the crew workday; on for 1.5 hrs starting 30 min prior to each scheduled eat period Four crewmen/two shift - On 13.3% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on for 1.5 hrs starting 30 min prior to each scheduled eat period Five crewmen/single shift - On 25% of the time during the crew workday; on for 2.5 hrs starting 30 min prior to each scheduled eat period; on from pwr xfr int until 1.0 hrs after OMS-2; on from 3.0 hrs prior to deorbit until EOM Five crewmen/two shift - On from pwr xfr int until 1.0 hrs after OMS-2; on 16.7% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on from 3.0 hrs prior to deorbit until EOM; on for 1.5 hrs starting 30 min prior to each scheduled eat period Six crewmen - On from pwr xfr int until 1.0 hrs after OMS-2; on 20.0% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on from 3.0 hrs prior to deorbit until EOM; on for 1.5 hrs starting 30 min prior to each scheduled eat period Seven, or more, crewmen - On from pwr xfr int until 1.0 hrs after OMS-2; on 23.3% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on from 3.0 hrs prior to deorbit until EOM; on for 1.5 hrs starting 30 min prior to each scheduled

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				eat period
03350200 MID DK FLDLT #2	16	7677	103,109,401, 403,423,433	Same as 03350100
03350300 MID DK FLDLT #3	16	7677	403,423	Usage is a function of crew size as follows: Two crewmen - On 10% of the time during the crew workday; on for 1.5 hrs starting 30 min prior to each scheduled eat period Three crewmen/single shift - On 15% of the time during the crew workday; on for 1.5 hrs starting 30 min prior to each scheduled eat period Three crewmen/two shift - On 10% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on for 1.5 hrs starting 30 min prior to each scheduled eat period Four crewmen/single shift - On 20% of the time during the crew workday; on for 1.5 hrs starting 30 min prior to each scheduled eat period Four crewmen/two shift - On 13.3% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on for 1.5 hrs starting 30 min prior to each scheduled eat period Five crewmen/single shift - On 25% of the time during the crew workday; on for 2.5 hrs starting 30 min prior to each scheduled eat period Five crewmen/two shift - On 16.7% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit;

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				on for 1.5 hrs starting 30 min prior to each scheduled eat period Six crewmen - On 20.0% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on for 1.5 hrs starting 30 min prior to each scheduled eat period Seven, or more, crewmen - On 23.3% of the time from OMS-2 plus 1.0 hrs until 3.0 hrs prior to deorbit; on for 1.5 hrs starting 30 min prior to each scheduled eat period
03350400 MID DK FLDLT #4	16	7677	403,423	Same as 03350300
03350500 MID DK FLDLT #5	16	7600	None	OFT - Not used OPS - TBD
03350600 MID DK FLDLT #6	16	7677	103,109,401, 403,423,433	Same as 03350100
03350610 MID DK FLDLT #6-EMER	16	7677	None	Not used (contingency equipment)
03350700 MID DK FLDLT #7	16	7677	403,423	Same as 03350300
03350710 MID DK FLDLT #7-EMER	16	7677	None	Not used (contingency equipment)
03350800 MID DK FLDLT #8	16	7677	103,109,401, 403,423,433	Same as 03350100

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03350810 MID DK FLDLT #8-EMER	16	7677	None	Not used (contingency equipment)
03360 SLEEP STATION LTS				FUNCTION: Provide illumination in the sleep station area. There are four lights with individual switches and dimming controls. USAGE: Sleep station lights are used at crew discretion. It is estimated that one light will be on per crewman for approximately one hour during both pre and post sleep activities. ANALYSIS USAGE:
03360100 (2) MD DK BNK 1/3 FL LTS	33	7600	427	OFT - Not used OPS - Both on for 1.0 hrs during both pre and post sleep activities
03360200 (2) MD DK BNK 2/4 FL LTS	33	7600	427	OFT - Not used OPS - Usage is a function of crew size and shift description, as follows: Two crewmen - Not used Three crewmen/single shift - On with a 50% usage factor, for 1.0 hrs during both pre and post sleep activities Three crewmen/two shift - Not used

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Four crewmen/single shift - On for 1.0 hrs during both pre and post sleep activities Four crewmen/two shift - Not used Five crewmen/single shift - On for 1.0 hrs during both pre and post sleep activities Five crewmen/two shift - On for 1.0 hrs, with a usage factor of 25%, during pre and post sleep activities Six crewmen - On for 1.0 hrs, with a usage factor of 50%, during pre and post sleep activities Seven, or more, crewmen - On for 1.0 hrs during pre and post sleep activities
03370 MID DECK PANEL LTS				FUNCTION: Illuminate the panel upon which the mid deck flood-light and airlock light control switches are mounted. There are two lights, mounted at opposite sides of the panel. USAGE: The panel lights are used at crew discretion. It is estimated that both lights will be on from OMS-2 plus 30 min until deorbit. ANALYSIS USAGE:
03370100 MID DECK PANEL LT #1	7	7677	051,401,107, 433	On from OMS-2 plus 30 min until deorbit

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03370200 MID DECK PANEL LT #2	7	7677	051,401,107, 433	Same as 03370100
03380 WAST MGMT CMPT				FUNCTION: Provides illumination in the waste management area. There is an individual on/off switch, but no dimming control. USAGE: The light is used at crew discretion. It is estimated that this light will be on for the duration of each waste management period, both pre and post sleep activities, and for the duration of the sleep period.
03380000 WAST MGT COMPARTMNT	16	7677	425,427,429	ANALYSIS USAGE: On for 30 min during pre and post sleep activities, and for the duration of the sleep period. Additional usage is a function of crew size and shift description, as follows: Single shift - Scheduled once per 24-hr day with a duration of 12 min times the crew size Two shift - Scheduled twice per 24-hr day with a duration of 6 min times the crew size
03390 PERSONAL HYGIENE LT				FUNCTION: Provides illumination in the personal hygiene area. There is an individual on/off switch, but no dimming control.

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				The light is used at crew discretion. It is estimated that this light will be on for some time during both pre and post sleep activities.
				ANALYSIS USAGE:
03390000 PERSONAL HYGIENE LT	16	7600	427	OFT - Not used
				OPS - On for 30 min during both pre and post sleep activities
03410 AIRLOCK FLDLIGHTS				FUNCTION:
				Provide illumination within the airlock. The lights have individual on/off controls.
				USAGE:
				Estimate two lights on from approximately 1.5 hrs pre EVA until about 1.0 hrs post EVA. One light will probably be on continuously during the crew workday for Spacelab operations.
				Note: All floodlights may be on during cold case attitudes to minimize condensation
				ANALYSIS USAGE:
03410100 AIRLOCK FLDLT #1	16	7677	417,419	On from 1.5 hrs prior to each scheduled EVA until 1.0 hrs post EVA
03410200 AIRLOCK FLDLT #2	16	7677	417,419	Same as 03410100

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03410300 AIRLOCK FLDLT #3	16	7677	403,415,417, 419	On from 1.5 hrs prior to each scheduled EVA until 1.0 hrs post EVA; also on during the crew workday for Spacelab payloads and during docking module operations for satellite refurbishment missions
03410400 AIRLOCK FLDLT #4	16	7677	417,419	Same as 03410100
03420 FLT DECK FLOODLTS				FUNCTION:
				Illuminate the main instrument panels and provide general field lighting in the forward and aft cabin areas. These lights are used in conjunction with the panel, instrument, and numeric lights (see 03310, 03320, and 03330). They have individual on/off and continuous dimming control.
				USAGE:
				Flight deck floodlighting is a function of crew activities and is at crew discretion. Estimates are as follows:
				OS Flight Deck Floodlights - Used to provide emergency illumination.
				Left Glareshield Floodlights - On half-bright from prelaunch through orbital reconfiguration. On one-fourth bright from orbital reconfiguration until EOM.
				Right Glareshield Floodlights - On half-bright from prelaunch through orbital reconfiguration. On one-fourth bright during the crew workday, during deorbit preps, and from deorbit to EOM.

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: The right and left glareshield floodlights will also be used to provide emergency illumination.
				Left Overhead Floodlights - Used only in support of specific mission, experiment, and crew activities.
				Note: One of these floodlights illuminates the center console. The other shines in the left crewman's lap to permit him to read while other crewmen are viewing objects external to the Orbiter.
				Right Overhead Floodlights - On bright from prelaunch through orbital reconfiguration and from 3 hrs prior to deorbit until EOM.
				Console Floodlights - Cmdr (L) - Used to provide emergency illumination of left side-panels. On during pre and post sleep activities, and for the duration of the sleep period.
				Console Floodlights - Pilot (R) - Used to provide emergency illumination of right side-panels.
				ANALYSIS USAGE:
03420100 FLIGHT DK FLDLTS-CS	19	7677	429	For crew sizes of 2, 3, 4, or 5 men working a single shift - On with a 25% usage factor during crew sleep periods
03420110 FLT DK FLDLTS-EMER	19	7677	None	Not used (contingency equipment)
03420200 GLARSHLD FLDLT-LFT	33	7677	051,103,107, 109,401,433	OFT - On with a 100% usage factor from pwr xfr int until 3.0 hrs after OMS-2; on with a 25% usage factor

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				from 3.0 hrs after OMS-2 until EOM OPS - On with a 100% usage factor from pwr xfr int until 1.0 hrs after OMS-2; on with a 25% usage factor from 1.0 hrs after OMS-2 until EOM
03420210 GLSHD FLDLT LFT EMER	33	7677	None	Not used (contingency equipment)
03420300 GLARSHLD FLDLT RHT	33	7677	051,103,107, 109,401,433	Same as 03420200
03420310 GLSHD FLDLT RHT EMER	33	7677	None	Not used (contingency equipment)
03420400 LFT OVERHEAD FLDLT A	22	7677	103,401	On with 100% usage factor from pwr xfr int through ascent reconfiguration.
03420500 RHT OVERHEAD FLDLT A	22	7677	103,109,401, 433	On with a 100% usage factor from pwr xfr int through ascent reconfiguration; on with a 100% usage factor from deorbit prep until EOM
03420600 CONSOLE FLDLT-CMD(L)	17	7677	103,401,427, 429	OFT - On with 100% usage factor from pwr xfr int through ascent reconfiguration; on with a 100% usage factor during pre and post sleep activities, and on with a 50% usage factor during the crew sleep periods OPS - On with 100% usage factor from pwr xfr int through ascent reconfiguration.
03420700 CONSOLE FLDLT-PLT(R)	17	7677	103,401	On with 100% usage factor from pwr xfr int through

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ascent reconfiguration.
03430 PL/MS STA FLDLTS				FUNCTION: Provide illumination of the payload and mission stations. The lights have individual on/off and continuous dimming controls. USAGE: Payload and mission station floodlighting is a function of crew activities and is at crew discretion. Estimates are as follows: Payload station Floodlight - On one-fourth bright during the PLB doors open and close sequences; during the latter phase of rendezvous (post NCC); during EVA, stationkeeping, and payload handling activities; and from approximately 30 min prior to RCS burns performed at the aft station through the burn. Mission station Floodlight - Same as Payload station Floodlight. ANALYSIS USAGE:
03430100 PAYLOAD STA FLD LT	33	7677	001,003,005, 055,305,405, 409,411,413, 417,419,435, 437,451,453, 455	OFT - Same as OPS except also on with a 25% usage factor during FTR's 151-1, 151-2, and 151-3 (STS-1 usage) and throughout the RMS checkout STS-2. OPS - On with a 25% usage factor from 30 min prior until 30 min after initiation of the PLB doors open and close sequences; during rendezvous, from 1.0 hrs prior to NCC until initiation of stationkeeping; from 30 min prior to RCS burns, performed at the aft station, through the post burn powerdown; from 30 min prior to until 30 min post EVA; and for station-

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				keeping, docking, undocking, payload operations and payload handling through those activities
03430200 MISSION STA FLD LT	33	7677	001,003,005, 055,305,405, 409,411,413, 417,419,435, 437,451,453, 455	Same as 03430100
03480 PLB FLDLIGHT ELEC ASSYS				FUNCTION: Provide a regulated 24 vdc for lights in the payload bay. Assembly 1 powers the Forward Port, Mid Port, Aft Starboard PLB Floodlights, and the Forward Bulkhead Mid Starboard, and Aft Port PLB Floodlights. See 03490 and 03540. USAGE: Assembly 1 will consume 25% of rated power (25W) for each of its four lights that is on. Assembly 2 will consume 33% of rated power (25W) for each of its three lights that is on. ANALYSIS USAGE:
03480100 PLB FLDLT ELEC ASY1	200	7677	001,003,005, 055,417,435, 437,451,453, 455	STS-1 - On with a 75% usage factor during payload TV operations; on with a 75% usage factor for for 30 min starting 10 min prior to the initiation of both the PLB doors open and close sequences; also on with 100% usage factor during FTR's 151-1, 151-2, and 151-3

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - On with a 75% usage factor during payload TV operations; on with a 75% usage factor for 30 min starting 10 min prior to the initiation of both PLB doors open and close sequences; on throughout RMS checkout activities. OPS - On during payload operations, handling, and EVA's
03480200 PLB FLDLT ELEC ASY2	195	7677	001,003,005, 417,435,437, 451,453,455	STS-1 - On during payload TV operations; on for 30 min starting 10 min prior to the initiation of both the PLB doors open and close sequences; also on during FTR's 151-1, 151-2, and 151-3 STS-2 - On during payload bay TV operations, on for 30 min prior to the initiation of both the PLB doors open and close sequences, including FTR's involving PLB door testing OPS - On during payload operations, payload handling, and EVA's
03490 PL BAY FLOODLTS				FUNCTION: Provide illumination to support Orbiter payload operations. The lights have individual on/off controls, and are powered by the indicated PLB Floodlight Electronics Assembly (See 03489). USAGE: Estimations are that all of the lights will be on during manipulator operations, during EVA's and during payload bay TV operations.

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
03490100 PLB FLD FWD PORT-EA1	150	7677	001,003,005, 055,417,435, 437,451,453, 455	STS-1 - On during payload bay TV operations, for 30 min starting 10 min prior to the initiation of both the PLB doors open and close sequences, and on during FTR's 151-1, 151-2, and 151-3 STS-2 - On during payload bay TV operations, for 30 min starting 10 min prior to the initiation of both the PLB doors open and close sequences, and throughout the RMS checkout activities OPS - On during payload operations, payload handling and EVA's
03490200 PLB FLD FWD STBD-EA2	150	7677	001,003,005, 055,417,435, 437,451,453, 455	Same as 03490100
03490300 PLB FLD MID PORT-EA1	150	7677	001,003,005, 055,417,435, 437,451,453, 455	Same as 03490100
03490400 PLB FLD MID STBD-EA2	150	7677	001,003,005, 055,417,435, 437,451,453, 455	Same as 03490100
03490500 PLB FLD AFT PORT-EA2	150	7677	001,003,005, 055,417,435, 437,451,453,	Same as 03490100

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			455	
03490600 PLB FLD AFT STBD-EA1	150	7677	001,003,005 055,417,435, 437,451,453, 455	Same as 03490100
03500 LH RMS FLOODLIGHT				FUNCTION: Illuminates the working area of the effector for direct viewing and for TV. The light has individual on/off and continuous dimming controls. USAGE: Estimated usage is full-bright during manipulator operations. ANALYSIS USAGE:
03500000 LH RMS FLOODLIGHT	132	7637	055,451,453	STS-1 - N/A STS-2 - On throughout the RMS checkout activities OPS - On during payload handling activities
03501 LH RMS FLDLT VOLT BOOSTER				FUNCTION: Provides constant voltage and current to LH RMS floodlight. USAGE:

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Function of LM RMS floodlight usage.
				ANALYSIS USAGE:
03501000 LRMS FLDLT VOLT BSTR	41	7637	055,451,453	STS-1 - N/A STS-2 - On throughout the RMS checkout activities OPS - On during payload handling activities
03510 OVHD DOCKING FLDLT				FUNCTION:
				Provides illumination during docking, undocking, payload grappling, and payload release operations. In addition, it may be used to provide a target for startracker lock-on to facilitate rendezvous with a second, active, Orbiter. The light has bright/dim/off control.
				USAGE:
				Estimate full on for docking and undocking, and for satellite deployment and retrieval.
				ANALYSIS USAGE:
03510000 OV DOCKING FLDLT EA2	130	7637	055,411,413, 451,453	STS-1 - N/A STS-2 - On throughout the RMS checkout activities OPS - On for 25 min beginning 15 min prior to docking, for the duration of undocking and payload deployment, and from 20 min prior to payload capture until payload capture plus 40 min
03540				

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FWD BULKHEAD FLDLT				FUNCTION: The forward bulkhead light provides general illumination of payloads for visual operations. Specifically, it illuminates the EVA handrails which run along the PLB door hinges. The light has bright/dim/off control and is powered by the PLB Floodlight Electronics Assembly #1 (See 03480100). USAGE: Full on for all manipulator operations, both with and without TV; for all PLB operations; and for all EVA activities. ANALYSIS USAGE:
03540000 FWD BULKHD FLDLT EA1	170	7677	417,451,453 455	On during EVA, payload operations, and payload handling
03550 C&W STATUS DISPLAY				FUNCTION: Displays, upon request, individual C&W parameter status, individual C&W parameter limit values, and channels which are inhibited. The unit requires power only when a crewman is taking a reading. Note: 1). The lamp test power level is approximately 20 watts. 2). This unit receives power through the caution and warning unit (ref. 03150). USAGE: Illuminated once per day during scheduled C&W lamp

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				testing. Otherwise, illuminated in contingency only.
				ANALYSIS USAGE:
03550000 C&W STATUS DISPLAY	20	7677	None	Not used (momentary power)
03560 C&W ANNUNCIATORS				FUNCTION:
				Identify subsystems which are malfunctioning. A light may be illuminated by any one of a group of related parameters. Once illuminated, a light will remain on until the causing paramete· returns within prescribed limits or until the crew disables the effected parameter.
				USAGE:
				Quiescent power is on continuously throughout all missions. Additional power is required only during contingencies.
				Note: Quiescent power may be eliminated by going to the "Acknowledge Mode." In this mode, no lights will illuminate until a crewman depresses a master alarm switch.
				ANALYSIS USAGE:
03560000 C&W ANNUN ASSY-OPR	88	7677	None	Not used (contingency usage)
03560010 C&W ANNUN ASSY-QUIES	8	7677	101	On from pwr xfr int to EOM
03710 CMPTR STAT ANNUN ASY				FUNCTION:
				Receives signals from the Computer Interface Control

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Unit and supplies power to a light matrix to indicate any "computer failed" vote.
				USAGE:
				Uses power only in the event of a computer failure, or a lamp test.
				ANALYSIS USAGE:
03710000 CMPTR STAT ANNUN ASY	31	7677	None	Not used
03720 CMPTR INTFC CNTL UN				FUNCTION:
				Detects discretes from the GPC's which indicates a "computer failed" vote and provide these signals to the computer status annunciator assembly. The Quiescent mode represents the "no failure" power consumption, the Operate mode represents the power consumption with all channels indicating failure.
				USAGE:
				Operate - On only with GPC failures. Quiescent - On continuously throughout all missions.
				ANALYSIS USAGE:
03720000 CICU-OPER	24	7677	None	Not used (contingency usage)
03720010 CICU-QUES	7	7677	101	On from pwr xfr int to EOM
03730 ANNUN CNTL ASSYS				FUNCTION:

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide the electronics which control the annunciator lights (see 03740). The quiescent mode represents the power consumed when none of the lights are on and the operate mode represents the power consumed when all assigned channels are on.
				USAGE:
				Annunciator Control Assembly operation is a function of crew activities. Estimates are as follows:
				It is estimated that the forward assemblies will be on during ascent and descent with approximately 30% of the lights illuminated, and on-orbit with approximately 10% of the lights illuminated.
				It is estimated that the aft assemblies will be on during the latter phase of rendezvous (post NCC); during EVA, stationkeeping, docking, undocking, and payload handling activities; and from approximately 30 min prior to RCS burns performed at the aft station through the burn. Approximately 10% of the lights will be illuminated in each instance.
				ANALYSIS USAGE:
03730100 ACA#1 L/OVHD	94	7677	103,105,109	On from pwr xfr int to OMS-2 cutoff at 35.3% usage. From OMS-2 cutoff to deorbit at 13.8% and from deorbit to EOM at 35.3% usage
03730200 ACA #2/#3 L/CNTR	189	7677	103,105,109	On from pwr xfr int to OMS-2 cutoff at 35.2% usage. From OMS-2 cutoff to deorbit at 13.7% and from deorbit to EOM at 35.2% usage
03730300 ACA #4/#5 R/AFT	149	7677	103,105,109	On from pwr xfr int to OMS-2 cutoff at 36.7% usage. From OMS-2 cutoff to deorbit at 15.6% and from deorbit

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				to EOM at 36.7% usage
03740 ANNUNCIATORS				FUNCTION: Annunciate event occurrences via indicator lights on control panels. Control for most annunciator lights is bright/dim, with continuous dimming in the "Dim" position. USAGE: The light levels are at crew discretion, while event occurrences are a function of crew activities. Estimates are as follows: Forward Annunciators - On full-bright during ascent and descent, with an average of about 30% of the lights illuminated. On full-dim when on-orbit, with an average of about 10% of the lights illuminated, in a given area, when the corresponding control assembly is on (see 03730). Aft Annunciators - On full-dim when on-orbit, with an average of about 10% of the lights illuminated, in a given area, when the corresponding control assembly is on (see 03730).
03740100 ANNUN LTS (ACA #1)	41	7677	103,105,109	ANALYSIS USAGE: On from pwr xfr int to OMS-2 cutoff at 30% usage factor. From OMS-2 cutoff until deorbit at 6.7%, and from deorbit to EOM at 30% usage factor
03740200 ANNUN LTS (ACA #2/#3)	77	7677	103,105 109	Same as 03740100

TABLE A-III.- DISPLAYS AND CONTROLS SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
03740300 ANNUN LTS (ACA #4/#5)	64	7677	103,105,109	Same as 03740100

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
04010 UPLNK TXT/GRAPH MACH				FUNCTION: Provides the capability to hard copy uplink text and graphics on thermally processed paper. USAGE: Estimated less than 6 hours per day ANALYSIS USAGE:
04010000 UPLNK TXT/GRAPH MTR	25	7600	None	OFT - N/A OPS - TBD
04020000 UPLNK TXT/GRAPH HTR	100	7600	None	OFT - N/A OPS - TBD
04030 PCM MASTER UNITS				FUNCTION: Acquire data from the OI MDM's and the Payload Data Interleaver, allow the GPC's to access all OI and P/L data, accept data inputs from the GPC's, and assemble the OI, P/L and GPC data into serial PCM streams for output. There are two PCM stream outputs from the PCMMU. Either a 128 kbps fixed format or a 128 kbps programmable format (selectable at the PCMMU) is output to the NSP for downlink and recording. A 64 kbps programmable format is also output to the NSP for downlink. The NSP selects either the 128 kbps or the 64 kbps PCM format, mixes it with either 32 kbps or 64 kbps of digitized voice and outputs the result to an S-Band Transponder for S-Band downlink or to the Ku-Band Signal Processor for Ku-Band downlink.

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Formats for the programmable PCMMU outputs are stored in the Mass Memory and may be changed during flight. The PCMMU also supplies clock signals to the NSP and to the PDI. The two units are redundant. USAGE: One on continuously throughout the mission. The PCMMU #1 is prime. The PCMMU formats must be reloaded from the Mass Memory if the PCMMU is turned off. ANALYSIS USAGE:
04030100 PCM MASTER UNIT #1	55	7677	101	On from pwr xfr int to EOM
04030210 PCM MASTER UNIT #2	55	7677	None	Not used (redundant equipment)
04040 RECORDERS				FUNCTION: OPS-1 Recorder - Records either 192 or 128 kbps data from the NSP including OI, P/L, GPC, and optional voice. During ascent, it records 60 kbps data from each of the SSME's instead of the NSP data. The recorder provides 3.5 hrs of record time at the speed used for NSP data and may be dumped via the S-Band FM xmtr. OPS-2 Recorder - Records the same NSP data as the OPS-1 recorder. The recorder provides 4.7 hrs of record time and may be dumped via the S-Band FM xmtr. Payload Recorder - TBD

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				OPS-1 Recorder usage is as follows:
				On in Record during ascent; on in Record during orbital operations when the OPS-2 recorder is dumping, otherwise in Standby; on in Standby during descent.
				OPS-2 Recorder usage is as follows:
				On in Record during ascent and descent; either on in Record or dump for all orbital operations. The dump ratio is 5:1 for 192 kbps data (recorded during crew day) and 8:1 for 128 kbps data (recorded during crew sleep - no voice).
				Payload Recorder usage is TBD.
				ANALYSIS USAGE:
04040100 OPS-1 RECORDER-REPLY	84	7677	None	Not used (usage accounted for in record/standby mode)
04040110 OPS-1 RECORDER-RECD	56	7677	123	On from pwr xfr int thru insertion
04040120 OPS-1 RECORDER-STBY	17	7677	105,109,211	On from insertion to EOM
04040200 OPS-2 RECORDER-REPLY	84	7677	None	Not used (usage accounted for in record mode)
04040210 OPS-2 RECORDER-RECD	56	7677	101	On from pwr xfr int to EOM
04040220 OPS-2 RECORDER-STBY	17	7677	None	Not used (usage accounted for in record mode)

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
04040300 PAYLD RECORDER-REPLY	84	7677	None	Not used (usage accounted for in record mode)
04040310 PAYLD RECORDER-RECD	56	7677	051,103,107, 109,401,433	STS-1 On with a 100% usage factor from T-5 min 30 sec until 15 min after OMS-2; from 1 hr prior to rehearsal deorbit and from 1 hr prior to deorbit until EOM. On with a 10% usage factor during all other orbital operations. STS-2 - Same as OPS OPS - On with a 100% usage factor from T-5 min 30 sec until 15 min after OMS-2 and from 1 hr prior to deorbit until EOM. On with a 10% usage factor during all other orbital operations.
04040320 PAYLD RECORDER-STBY	17	7677	None	Not used (usage accounted for in record mode)
04050 DED SIG CND - FWD				FUNCTION: Provide excitation and conditioning for up to 120 OFI measurements. Each channel outputs two, 0 to 5 vdc, signals which may be used for OI MDM's, dedicated displays, and/or C&W inputs. USAGE: All on continuously throughout all missions. ANALYSIS USAGE:
04050100 DED SIG CND OF1 - FWD	23	7677	101	On from pwr xfr int to EOM
04050200				

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
DED SIG CND OF2 - FWD	33	7677	101	On from pwr xfr int to EOM
04050300 DED SIG CND OF3 - FWD	27	7677	101	On from pwr xfr int to EOM
04060 DED SIG CND - AFT				FUNCTION: Provide excitation and conditioning for up to 120 OFI measurements. Each channel outputs two, 0 to 5 vdc signals, which may be used for OI MDM's, dedicated displays, and/or C&W inputs. USAGE: All on continuously throughout all missions. ANALYSIS USAGE:
04060100 DED SIG CND OA1 - AFT	36	7677	101	On from pwr xfr int to EOM
04060200 DED SIG CND OA2 - AFT	29	7677	101	On from pwr xfr int to EOM
04060300 DED SIG CND OA3 - AFT	29	7677	101	On from pwr xfr int to EOM
04090 MASTER TIMING UNIT				FUNCTION: Provides a time standard with an accuracy of one part in one billion. The unit contains two crystal oscillators which are temperature controlled. In the event of a failure of one oscillator, the unit will automatically switchover to the remaining oscillator. Switchover requires less than 125 microseconds. The MTU is the primary source of time to the GPC's, PCM,

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				crew displays and recorders. It is also the prime source of synchronization for the inverters and PCMMU's. The unit is internally redundant.
				USAGE:
				Warm-up Mode - On during subsystem activation (prior to pwr xfr int).
				Operate Mode - On continuously throughout all missions.
				ANALYSIS USAGE:
04090000 MTU - WMUP	40	7677	None	Not used (GSE power/usage)
04090010 MTU - OPER	31	7677	101	On from pwr xfr int to EOM
04110 PLD DATA INTERLEAVER				FUNCTION:
				Decommutates and selectively reformats up to 64 kbps of PCM data, from up to five attached payloads and one detached payload, for interleaving with the Orbiter operational telemetry.
				USAGE: TBD
				ANALYSIS USAGE:
04110000 PLD DATA INTERLEAVER	40	7603	None	TBD
04120 DED SIG CNDS-OMS/RCS				FUNCTION:
				Provide excitation and conditioning for up to 60 OMS/

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				RCS OFI measurements. Each channel outputs two, 0 to 5 vdc, signals which may be used for OI MDM's, dedicated displays, and/or C&W inputs.
				USAGE:
				All on continuously throughout all missions.
				ANALYSIS USAGE:
04120100 DSC OL1 OMS/RCS	23	7677	101	On from pwr xfr int to EOM
04120200 DSC OL2 OMS/RCS	21	7677	101	On from pwr xfr int to EOM
04120300 DSC OR1 OMS/RCS	23	7677	101	On from pwr xfr int to EOM
04120400 DSC OR2 OMS/RCS	21	7677	101	On from pwr xfr int to EOM
04130 DED SIG CNDS - MID FUS				**FUNCTION:**
				Provide excitation and conditioning for up to 60 Midbody OFI measurements. Each channel outputs two, 0 to 5 vdc, signals which may be used for OI MDM's, dedicated displays, and/or C&W inputs.
				USAGE:
				All on continuously throughout all missions.
				ANALYSIS USAGE:
04130100 DSC OM1 MID FUS	14	7677	101	On from pwr xfr int to EOM

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
04130200 DSC OM2 MID FUS	22	7677	101	On from pwr xfr int to EOM
04140 DED SIG CNDS - FWD RCS				FUNCTION: Provides excitation and conditioning for up to 120 forward RCS OFI measurements. Each channel outputs two, 0 to 5 vdc signals which may be used for OI MDM's, dedicated displays, and/or C&W inputs. USAGE: On continuously throughout all missions. ANALYSIS USAGE:
04140000 DSC OF4 FWD RCS	27	7677	101	On from pwr xfr int to EOM
04160 WDBND SIG COND (BAY 4)				FUNCTION: Provides excitation and conditioning for 4 APU vibration measurements. Each channel outputs a 0 to 5 vdc signal to an OI MDM. USAGE: Required to be on when the APU's are on. Usage depends upon MDM's OA1, OA2, and OA3 and dedicated signal conditioners OA1, OA2, and OA3 (see 04060 and 07110) which use the same switch. On from pwr xfr int to EOM. ANALYSIS USAGE:
04160100 WDBND S/C = 1 (BAY 4)	1	7677	None	Not used (low power)

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
04160200 WDBND S/C = 2 (BAY 4)	1	7677	None	Not used (low power)
04160300 WDBND S/C = 3 (BAY 4)	1	7677	None	Not used (low power)
04160400 WDBND S/C = 4 (BAY 4)	1	7677	None	Not used (low power)
04170 WDBND SIG COND (BAY 5)				FUNCTION: Provides excitation and conditioning for 2 APU vibration measurements. Each channel outputs a 0 to 5 vdc signal to an OI MDM. USAGE: Required to be on when the APU's are on. Usage depends upon MDM's OA1, OA2, and OA3, and dedicated signal conditioners OA1, OA2, and OA3 (see 04060 and 07110) which use the same switch. On from pwr xfr int to EOM. ANALYSIS USAGE:
04170100 WDBND S/C = 1 (BAY 5)	1	7677	None	Not used (low power)
04170200 WDBND S/C = 2 (BAY 5)	1	7677	None	Not used (low power)
04180 INTERFACE CONTROL MODULE - OFT				FUNCTION: TBD

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				TBD
04180000 INTF CNTL MOD-OFT	10	0077	TBD	ANALYSIS USAGE:
				TBD
04200 INTERFACE MODULES				FUNCTION:
				House the equipment which provides the interconnections between the various components of the Shuttle Infrared Leeside Temperature Sensing (SILTS) experiment. They contain patch panels, transformers, and voltage controlled oscillators (VCO's).
				Note: This equipment will be installed on Flights 10 through 12 only.
				USAGE:
				When installed, both are turned on by the GPC switch from mode 303 (deorbit) to mode 304 (entry) at approximately 5 min prior to 400,000 ft. They remain on until powered down by the crew after landing.
				ANALYSIS USAGE:
04200100 INTF DATA MODULE	135	2000	503,505	OFT - N/A
				OPS - On from 5 min prior to entry interface until EOM, when installed
04200200 INTF CNTL MOD-SILTS	8	2000	503,505	OFT - N/A

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)		ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On from 5 min prior to entry interface until EOM, when installed
04210 OEX TAPE RECORDER				FUNCTION:
				Provides data storage capability for SILTS data. This Orbiter Experiments (OEX) recorder is identical to the DFI MARS recorder (See 05091000) and provides 60 min of record time at 30 ips.
				Note: This equipment will be installed on Flights 10 through 12 only.
				USAGE:
				When installed, the recorder is turned on by the GPC switch from mode 303 (deorbit) to mode 304 (entry) at approximately 5 min prior to 400,000 ft. It remains on until powered down by the crew after landing.
				ANALYSIS USAGE:
04210000 OEX TAPE RECORDER	140	2000	503,505	OFT - N/A
				OPS - On from 5 min prior to entry interface until EOM, when installed
04220 TIME CODE PROC SYS				FUNCTION:
				Provides IRIG-B time code to the interface module VCO for recording on the OEX Tape Recorder.
				Note: This equipment will be installed on Flights 10 through 12 only.

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				When installed, activated by the GPC switch from mode 303 (deorbit) to mode 304 (entry) at approximately 5 min prior to 400,000 ft. It remains on until powered down by the crew after landing.
				ANALYSIS USAGE:
04220000 TIME CODE PROC SYS	10	2000	503,505	OFT - N/A
				OPS - On from 5 min prior to entry interface until EOM, when installed
04250 CAMERA POINTING MTR				FUNCTION:
				Moves the SILTS infrared camera through the following seven second cycle:
				1) View front window (1 sec) 2) Move to Black Body (1 sec) 3) View Black Body (1 sec) 4) Move to left window (1 sec) 5) View left window (1 sec) 6) Move back to front window (2 sec) Note: This equipment will be installed on Flights 10 through 12 only.
				USAGE:
				When installed, the cycle is initiated by the GPC switch from mode 303 (deorbit) to mode 304 (entry) at approximately 5 min prior to 400,000 ft. It continues to cycle until powered down by the crew after landing.
				ANALYSIS USAGE:

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
04250000 CAMERA POINTING MTR	25	2000	503,505	OFT - N/A OPS - On from 5 min prior to entry interface until EOM, when installed
04270 CAMERA GN2 VALVE				FUNCTION: Controls the flow of GN2 coolant from the supply to the SILTS infrared camera. This is a latching solenoid valve, requiring momentary power to open or close (0.5 sec max). Note: This equipment will be installed on Flights 10 through 12 only. USAGE: When installed, closed until initiation of experiment operation. Opened (momentary power) by the GPC switch from mode 303 (deorbit) to mode 304 (entry) at approximately 5 min prior to 400,000 ft. ANALYSIS USAGE:
04270000 CAMERA GN2 VALVE	47	2000	None	OFT - N/A OPS - Not used (momentary power)
04280 WINDOW GN2 VALVE				FUNCTION: Controls the flow of GN2 coolant from the supply to the SILTS windows. This is a latching solenoid valve, requiring momentary power to open or close (0.5 sec max).

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: This equipment will be installed on Flights 10 through 12 only.
				USAGE:
				When installed, closed until initiation of experiment operation. Opened (momentary power) by the GPC switch from mode 303 (deorbit) to mode 304 (entry) at approximately 5 min prior to 400,000 ft.
				ANALYSIS USAGE:
04280100 WINDOW GN2 VALVE #1	47	2000	None	OFT - N/A
				OPS - Not used (momentary power)
04280200 WINDOW GN2 VALVE #2	47	2000	None	N/A
				Note: This component is to be deleted.
04280300 WINDOW GN2 VALVE #3	47	2000	None	N/A
				Note: This component is to be deleted.
04290 DATA AMP MODULE				FUNCTION:
				Provides data amplification for OEX Tape Recorder playback. This module is GSE.
				USAGE:
				Used post-flight only.
				ANALYSIS USAGE:
04290000 DATA AMP MODULE	62	2000	None	Not used (GSE power/usage)

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
04410 AERO COEFF IDENT PACKAGE (ACIP)				FUNCTION: Monitors Shuttle dynamics during ascent and re-entry. USAGE: On during ascent and re-entry ANALYSIS USAGE:
04410100 ACIP ELECT PACKAGE	94	0077	123,211,509	OFT - On from pwr xfr int to insertion plus 2 min, and from 42 min prior to TD until 6 min 30 sec after stoproll OPS - N/A
04410200 ACIP PCM MASTER	15	0077	123,211,509	OFT - Same as 04410100 OPS - N/A
04410300 ACIP PCM SLAVE	10	0077	123,211,509	OFT - Same as 04410100 OPS - N/A
04410400 ACIP MINI DHE	1	0077	123,211,509	OFT - Same as 04410100 OPS - N/A
04450 INTERFACE CNTL MODULE (ACIP)				FUNCTION: Provides interface between the Orbiter and ACIP

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				experiment package USAGE: On concurrently with ACIP experiment. ANALYSIS USAGE:
04450000 INTF CNTL MOD-ACIP	4	0077	123,211,509	OFT - Same as 04410100 OPS - N/A
04500 SILTS POD THRMAL HTR				FUNCTION: Maintains the SILTS tail pod components within required thermal limits during the orbital coast period prior to experiment operation. Note: This equipment will be installed on Flights 10 through 12 only. USAGE: When installed, enabled by the crew following the OMS-2 burn, disabled prior to the deorbit burn. When enabled it is thermostatically controlled, duty cycle is a function of attitude and beta angle. ANALYSIS USAGE:
04500000 SILTS POD THRMAL HTR	85	2000	600 series	OFT - N/A OPS - See appendix B heater tables
04510				

TABLE A-IV.- OPERATIONAL FLIGHT INSTRUMENTATION SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
ACIP HEATERS				FUNCTION: Provides a controlled thermal environment for the ACIP electronics. USAGE: TBD. ANALYSIS USAGE:
04510000 ACIP ELECT HEATER	50	0077	600 series	STS-1 - See appendix B STS-2 - See appendix B OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05010 PWR DIST ASSY FWD				FUNCTION: Supplies 28 vdc power to the DFI components in the fwd area. USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05010000 PWR DIST ASSY FWD	10	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05020 PWR DIST ASSYS-MID				FUNCTION: Supply 28 vdc power to the DFI components in the mid-fuselage area. USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05020100 PWR DIST ASSY#1 MID	10	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05020200 PWR DIST ASSY#2 MID	10	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05020300 PWR DIST ASSY#3 MID	10	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05030 PCM MASTER UNITS				FUNCTION: Acquire data from the DFI MDM's for output. There is only one output format which is a fixed 128 kbps. There are physically two outputs from each PCMMU. One goes to the DFI PCM recorder and the other goes to forward FDM #1 for subsequent downlink on the DFI S-Band link. USAGE: One on throughout all OFT flights. PCMMU #1 is normally considered prime, however, they are both identical. The PCMMU formats do not have to be reloaded when a PCMMU is turned off.
05030100 PCM MASTER UNIT #1	55	0077	117	ANALYSIS USAGE: OFT - On from pwr xfr int to EOM OPS - N/A
05030210 PCM MASTER UNIT #2	55	0077	None	Not used (redundant equipment)
05040 DED SCU'S FWD				FUNCTION: Provide excitation and conditioning for up to 120

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				DFI measurements. Output 0-5 vdc signals to DFI MDM's. USAGE: All on continuously throughout all OFT flights. ANALYSIS USAGE:
05040100 DSC FWD #1-SDF1	22	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05040200 DSC FWD #2-SDF2	22	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05040300 DSC FWD #3-SDF3	23	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05050 DED SCU'S MID				FUNCTION: Provide excitation and conditioning for up to 120 DFI measurements. Output 0-5 vdc signals to DFI MDM's. USAGE: All on continuously throughout all OFT flights. ANALYSIS USAGE:
05050100 DSC UNIT #1-SDL1	17	0077	117	OFT - On from pwr xfr int to EOM

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	[illegible]	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05050200 DSC UNIT #2-SDL2	25	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05050300 DSC UNIT #3-SDL3	17	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05050400 DSC UNIT #4-SDL4	25	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05050500 DSC UNIT #5-SDL5	47	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05050600 DSC UNIT #1-SDR1	17	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05050700 DSC UNIT #2-SDR2	25	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05050800 DSC UNIT #3-SDR3	17	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05050900 DSC UNIT #4-SDR4	47	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05060 DED SCU'S MID				FUNCTION: Provide excitation and conditioning for up to 120 DEI measurements. Output 0-5 vdc signals to LFI MDM's. USAGE: All on continuously throughout all OFT flights. ANALYSIS USAGE:
05060100 DSC UNIT #1-SDC1	17	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05060200 DSC UNIT #2-SDC2	24	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05060300 DSC UNIT #3-SDC3	17	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05060400 DSC UNIT #4-SDC4	18	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS,	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05060500 DSC UNIT #5-SDC5	17	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05070 WDBND FDM UNITS-FWD				FUNCTION: Frequency division multiplex up to 60 channels of wideband data into 4 signals (15 channels each) for output to the Wideband Ascent or MARS recorder. FDM #1 provides an additional output, which consists of the combination of the 128 kbps PCM stream from the DFI PCMMU and one of the 4 multiplexed signals. This output, (which includes 12 kbps ET PCM) on a 1.024 MHz subcarrier, is routed to the DFI S-Band system for downlink. USAGE: All FDM units are on during ascent. Unit #1 is on at 50% power for the remainder of the flight, while units #2 and #3 are on for OMS burns and descent. ANALYSIS USAGE:
05070100 WB FDM IA (FMF1)-FWD	25	0077	103,117,401	OFT - On from pwr xfr int to OMS-2 plus 30 min; on with a 50% usage factor during the remainder of the mission OPS - N/A
05070200 WB FDM IB (FMF1)-FWD	25	0077	103,117,401	OFT - On from pwr xfr int to OMS-2 plus 30 min; on with a 50% usage factor during the remainder of the mission

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05070300 WB FDM 2A (FMF2)-FWD	25	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05070400 WB FDM 2B (FMF2)-FWD	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05070300 STS-2 - Same as 05070300 OPS - N/A
05070500 WB FDM 3A (FMF3)-FWD	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05070300 STS-2 - Same as 05070300 OPS - N/A
05070600 WB FDM 3B (FMF3)-FWD	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05070300 STS-2 - Same as 05070300 OPS - N/A
05080				

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
WDBND FDM UNITS-MID				FUNCTION:
				Frequency division multiplex up to 60 channels of wideband data into 4 signals (15 channels each) for output to the Wideband Ascent or MARS recorder.
				USAGE:
				All on during ascent, OMS burns, and descent.
				ANALYSIS USAGE:
05080100 WDBND FDM UN1-MID L1	25	0077	051,103,109 301,401,433	STS-1 - On from pwr xfr to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM
				STS-2 - On from pwr xfr to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM
				OPS - N/A
05080200 WDBND FDM UN1-MID L1	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05080100
				STS-2 - Same as 05080100
				OPS - N/A
05080300 WDBND FDM UN2-MID L1	25	0077	051,103,109 301,401,433	STS-1 - Same as 05080100
				STS-2 - Same as 05080100
				OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05080400 WDBND FDM UN2-MID L1	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05080100 STS-2 - Same as 05080100 OPS - N/A
05080500 WDBND FDM UN1-MID R2	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05080100 STS-2 - Same as 05080100 OPS - N/A
05080600 WDBND FDM UN1-MID R2	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05080100 STS-2 - Same as 05080100 OPS - N/A
05080700 WDBND FDM UN2-MID R2	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05080100 STS-2 - Same as 05080100 OPS - N/A
05080800 WDBND FDM UN2-MID R2	25	0077	051,103,109, 301,401,433	STS-1 - Same as 05080100 STS-2 - Same as 05080100 OPS - N/A
05081 WDBND FDM UNITS-MID				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Frequency division multiplex up to 60 channels of wideband data into 4 signals (15 channels each) for output to the Wideband Ascent or MARS recorder.
				USAGE:
				Three on during ascent. One on during OMS burns and descent.
				ANALYSIS USAGE:
05081100 WDBND FDM UN1-MID L3	25	0077	103,401	OFT - On from pwr xfr int to OMS-2 plus 30 min
				OPS - N/A
05081200 WDBND FDM UN1-MID L3	25	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM
				STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM
				OPS - N/A
05081300 WDBND FDM UN2-MID L3	50	0077	103,401	OFT - On from pwr xfr int to OMS-2 plus 30 min
				OPS - N/A
05082 FREON FLOWMETER				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Measures freon flow in midbody USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05082000 FREON FLOMTR-MID LT3	2	0077	117	OFT - on from pwr xfr int to EOM OPS - N/A
05083 LOAD SENSOR ACCELEROMETER				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
05083100 LOAD SEN ACCEL-1 FWD	4	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05083200 LOAD SEN ACCEL-2 FWD	4	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05083300 LOAD SEN ACCEL-MR 2	14	0077	117	OFT - Same as 05083200 OPS - N/A
05083400 LOAD SEN ACCEL-MR 3	10	0077	117	OFT - Same as 05083200

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05090 WIDEBAND ASCENT RECORDERS				FUNCTION: Wideband Ascent Recorder - Records 7 wideband, multiplexed outputs from three Orbiter FDM's, two tracks of SRB data, and five tracks of ET data. The fourteen tracks are recorded in parallel. The recorder provides approximately 30 min of record time and has no in-flight dump capability. USAGE: Wideband Ascent Recorder - On for approximately 15 min during ascent on all OFT flights. ANALYSIS USAGE:
05090100 WDBND RCDR(ASC) - REPR	83	0077	None	OFT - Not used OPS - N/A
05090110 WDBND RCDR(ASC) - RECD	70	0077	123,211	OFT - On from L/O minus 30 sec to insertion plus 5 min OPS - N/A
05090120 WDBND RCDR(ASC) - STBY	17	0077	201	OFT - On from pwr xfr int to L/O minus 30 sec OPS - N/A
05091 WDBND MSN RCDR (MARS)				FUNCTION: Records the wideband, multiplexed outputs of 8 Orbiter FDM's. Twenty-eight tracks are recorded in parallel.

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				The recorder provides approximately 2 hrs of record time and has no in-flight dump capability. USAGE: On for approximately 15 min during ascent, during all OMS burns, and during descent on all OFT flights. ANALYSIS USAGE:
05091000 WDBND RCDR (MARS)	59	0077	111,123,211, 301,311,433	STS-1 - On from L/O minus 30 sec to insertion plus 5 min; on from 30 sec prior to each OMS burn until the end of the burn; on for 30 sec starting 30 sec prior to the rehearsal deorbit; and on from 30 sec prior to deorbit through stoproll STS-2 - On from L/O minus 30 sec to insertion plus 5 min; on from 30 sec prior to each OMS burn until the end of the burn; and on from 30 sec prior to deorbit through stoproll OPS - N/A
05092 DRIVER AMPLIFIER MODULE				FUNCTION: Provides the necessary playback electronics to dump the MARS recorder postlanding. USAGE: On after TD as required to dump recorder. ANALYSIS USAGE:
05092000 DRIVER AMP MODULE	56	0077	None	Not used (GSE power usage)

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05093 PCM RECORDERS				FUNCTION: PCM Recorder - Records the serial, 128 kbps PCM output of the DFI PCMMU. The fourteen tracks are recorded in series, one at a time. The recorder provides approximately 7 hrs of record time and has no in-flight dump capability. USAGE: PCM Recorder - Records continuously from pwr xfr int through insertion and during entry from deorbit through stoproll. On-orbit, cycles continually between Record and Standby (Record for 9 sec; Standby for 5 min). In this mode, full electronics are on so power consumption is approximately equal to the Record mode. ANALYSIS USAGE:
05093000 PCM RCDR-REPR-SERIAL	84	0077	None	OFT - Not used OPS - N/A
05093010 PCM RCDR-RECD-SERIAL	56	0077	103,105,109	OFT - On from L/O minus 30 sec until EOM OPS - N/A
05093020 PCM RECORDER - STBY	17	0077	201	OFT - On from pwr xfr int to L/O minus 30 sec OPS - N/A
05101 WDBND SCU'S FWD				

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
(A131)				FUNCTION: Provide excitation and conditioning for peizoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The Ascent WBSC's are on only during ascent. The 100% WBSC's are on continuously throughout all OFT flights. ANALYSIS USAGE:
05101100 (8) WBSC FWD (A131)-100%	3	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05101200 (14) WBSC FWD (A131)-ASCT	5	0077	103,401	OFT - On from pwr xfr int to OMS-2 plus 30 min OPS - N/A
05102 WDBND SCU'S FWD (A132)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: WDM WBSC's are on during ascent, OMS burns, and descent. ANALYSIS USAGE:
05102000 (17)				

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
WBSC FWD (A132)-WBM	6	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05103 WDBND SCU'S FWD (A133)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The ascent WBSC's are on only during ascent from pwr xfr int to OMS-2 plus 30 min, while the WBM WBSC's are on during ascent, OMS burns, and descent. The spare WBSC's are not used.
05103100 WBSC FWD (A133)-ASCT	1	0077	None	ANALYSIS USAGE: OFT - Not used (low power) OPS - N/A
05103200 (22) WBSC FWD (A133)-WBM	8	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05103300 (2) WBSC FWD (A133)-SPRS	1	0077	None	OFT - Not used OPS - N/A
05104 WDBND SCU'S FWD (A134)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. The spare WBSC's are not used. ANALYSIS USAGE:
05104100 (27) WBSC FWD (A134)-WBM	10	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				burn, and from 30 min prior to deorbit until EOM OPS - N/A
05104200 (3) WBSC FWD (A134)-SPRS	1	0077	None	OFT - Not used OPS - N/A
05111 WDBND SCU'S LM1 (A135)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. The spare WBSC's are not used. ANALYSIS USAGE:
05111100 (8) WBSC LM1 (A135)-WBM	3	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05111200 (10)				

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
WBSC LM1 (A135)-WBM	4	0077	051,103,109, 301,401,433	STS-1 - Same as 05111100 STS-2 - Same as 05111100 OPS - N/A
05111300 (3) WBSC LM1 (A135)-SPRS	1	0077	None	OFT - Not used OPS - N/A
05112 WDBND SCU'S LM1 (A136)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent.
05112100 (10) WBSC LM1 (A136)-WBM	4	0077	051,103,109, 301,401,433	ANALYSIS USAGE: STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05112200 (11) WBSC LM1 (A136)-WBM	4	0077	051,103,109, 301,401,433	STS-1 - Same as 05112100 STS-2 - Same as 05112100 OPS - N/A
05113 WDBND SCU'S LM1 (A137)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. ANALYSIS USAGE:
05113100 (15) WBSC LM1 (A137)-WBM	5	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05113200 (13) WBSC LM1 (A137)-WBM	5	0077	051,103,109,	STS-1 - Same as 05113100

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			301,401,433	STS-2 - Same as 05113100 OPS - N/A
05114 WDBND SCU'S LM1 (A138)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. ANALYSIS USAGE:
05114100 (11) WBSC LM1 (A138)-WBM	4	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05114200 (15) WBSC LM1 (A138)-WBM	5	0077	051,103,109, 301,401,433	STS-1 - Same as 05114100 STS-2 - Same as 05114100 OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05121 WDBND SCU'S RM2 (A139)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. The spare WBSC's are not used. ANALYSIS USAGE:
05121100 (8) WBSC RM2 (A139)-WBM	3	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05121200 (9) WBSC RM2 (A139)-WBM	3	0077	051,103,109, 301,401,433	STS-1 - Same as 05121100 STS-2 - Same as 05121100 OPS - N/A
05121300 (4) WBSC RM2 (A139)-SPRS	2	0077	None	OFT - Not used

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05122 WDBND SCU'S RM2 (A140)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. ANALYSIS USAGE:
05122100 (9) WBSC RM2 (A140)-WBM	3	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05122200 (8) WBSC RM2 (A141)-WBM	3	0077	051,103,109, 301,401,433	STS-1 - Same as 05122100 STS-2 - Same as 05122100 OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05123 WDBND SCU'S RM2 (A141)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. ANALYSIS USAGE:
05123100 (14) WBSC RM2 (A141)-WBM	5	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05123200 (13) WBSC RM2 (A141)-WBM	5	0077	051,103,109, 301,401,433	STS-1 - Same as 05123100 STS-2 - Same as 05123100 OPS - N/A
05124 WDBND SCU'S RM2 (A142)				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The WBM WBSC's are on during ascent, OMS burns, and descent. ANALYSIS USAGE:
05124100 (9) WBSC RM2 (A142)-WBM	3	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05124200 (16) WBSC RM2 (A142)-WBM	6	0077	051,103,109, 301,401,433	STS-1 - Same as 05124100 STS-2 - Same as 05124100 OPS - N/A
05131 WDBND SCU'S LM3 (A143)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS.

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				The Ascent WBSC's are on only during ascent.
				ANALYSIS USAGE:
05131100 (25) WBSC LM3 (A143)-ASCT	9	0077	103,401	OFT - On from pwr xfr int to OMS-2 plus 30 min
				OPS - N/A
05131200 WBSC LM3 (A143)-SPRS	1	0077	None	OFT - Not used
				OPS - N/A
05132 WDBND SCU'S LM3 (A144)				FUNCTION:
				Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS.
				USAGE:
				The Ascent WBSC's are on only during ascent. The WBM WBSC's are on during ascent, OMS burns and descent.
				ANALYSIS USAGE:
05132100 (7) WBSC LM3 (A144)-ASCT	2	0077	103,401	OFT - On from pwr xfr int to OMS-2 plus 30 min
				OPS - N/A
05132200 (20) WBSC LM3 (A144)-WBM	7	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05133 WDBND SCU'S LM3 (A145)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The Ascent WBSC's are on only during ascent. The 100% WBSC's are on continuously throughout all OFT flights. ANALYSIS USAGE:
05133100 (11) WBSC LM3 (A145)-ASCT	4	0077	103,401	OFT - On from pwr xfr int to OMS-2 plus 30 min OPS - N/A
05133200 (8) WBSC LM3 (A145)-100%	3	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05133300 (9) WBSC LM3 (A145)-100%	3	0077	117	OFT - On from pwr xfr int to EOM

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05134 WDBND SCU'S LM3 (A146)				FUNCTION: Provide excitation and conditioning for piezoelectric wideband transducers. Each channel outputs a 0 to 5 vdc signal which is routed to the DFI FDMS. USAGE: The Ascent WBSC's are on only during ascent.
05134000 (28) WBSC LM3 (A146)-ASCT	10	0077	103,401	ANALYSIS USAGE: OFT - On from pwr xfr int to OMS-2 plus 30 min OPS - N/A
05140 DC-DC TRANSDUCERS				FUNCTION: Provide power and signal conditioning for pressure transducers; 0-5V output to a DFI MDM. USAGE: The DC-DC transducers are on during ascent, OMS burns, and descent.
05140100 (9) DC-DC XDUCERS-FWD	16	0077	051,103,109, 301,401,433	ANALYSIS USAGE: STS-1 - From 5 min prior to each OMS burn until the end of the burn; on from pwr xfr int to OMS-2 plus 30 min; from 30 min prior to until 30 min after

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - From 5 min prior to each OMS burn until the end of the burn; on from pwr xfr int to OMS-2 plus 30 min; and from 30 min prior to deorbit until EOM OPS - N/A
05140200 (3) DC-DC XDUCERS-FWD	5	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05140300 (31) DC-DC XDUCERS-FWD	6	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05140400 (17) DC-DC XDUCERS-MID L1	31	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05140500 (41) DC-DC XDUCERS-MID L1	8	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05140600 (3) DC-DC XDUCERS-MID L1	5	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05140700 (16) DC-DC XDUCERS-MID R2	29	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05140800 (10) DC-DC XDUCERS-MID R2	2	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05140900 (2) DC-DC XDUCERS-MID R2	4	0077	051,103,109, 301,401,433	STS-1 - Same as 05140100 STS-2 - Same as 05140100 OPS - N/A
05141 DC-DC TRANSDUCERS				FUNCTION: Provide power and signal conditioning for pressure transducers; 0-5V output to a DFI MDM. USAGE: The DC-DC pressure transducers are on during ascent,

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OMS burns, and descent.
				ANALYSIS USAGE:
05141100 (4) DC-DC XDUCERS-MID L3	1	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min; from 5 min prior to each OMS burn until the end of the burn; from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min; from 5 min prior to each OMS burn until the end of the burn; and from 30 min prior to deorbit until EOM OPS - N/A
05141200 (22) DC-DC XDUCERS-MID L3	40	0077	051,103,109, 301,401,433	STS-1 - Same as 05141100 STS-2 - Same as 05141100 OPS - N/A
05150 STRAIN GAGE SCU'S FWD (A161)				FUNCTION: Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There are up to 4 measurements per SCU. USAGE: The WBM SGSC's are on during ascent, OMS burns, and descent. The 100% SGSC's are on continuously throughout all OFT flights.

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
05150100 (3) SGSC FWD (A161)-100%	23	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05150200 (3) SGSC FWD (A161)-100%	16	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05150300 (3) SGSC FWD (A161)-WBM	6	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05150400 (2) SGSC FWD (A161)-WBM	15	0077	051,103,109, 301,401,433	STS-1 - Same as 05150300 STS-2 - Same as 05150300 OPS - N/A
05161 STRAIN GAGE SCU'S ML1 (A162)				FUNCTION: Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				are up to 4 measurements per SCU.
				USAGE:
				The WBM SGSC's are on during ascent, OMS burns, and descent. The 100% SGSC's are on continuously throughout all OFT flights.
				ANALYSIS USAGE:
05161100 (17) SGSC ML1 (A162)-100%	93	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05161200 (2) SGSC ML1 (A162)-WBM	15	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM
				STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM
				OPS - N/A
05161300 (2) SGSC ML1 (A162)-WBM	15	0077	051,103,109, 301,401,433	STS-1 - Same as 05161200
				STS-2 - Same as 05161200
				OPS - N/A
05162 STRAIN GAGE SCU'S ML1 (A163)				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There are up to 4 measurements per SCU. USAGE: The WBM SGSC's are on during ascent, OMS burns, and descent. The 100% SGSC's are on continuously throughout all OFT flights. ANALYSIS USAGE:
05162100 (12) SGSC ML1 (A163)-100%	66	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05162200 (4) SGSC ML1 (A163)-WBM	31	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05162300 SGSC ML1 (A163)-WBM	8	0077	051,103,109, 301,401,433	STS-1 - Same as 05162200 STS-2 - Same as 05162200 OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05162400 SGSC ML1 (A163)-100%	8	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05162500 (4) SGSC ML1 (A163)-100%	31	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05163 STRAIN GAGE SCU'S MR2 (A164)				FUNCTION: Provide power and signal conditioning for strain gages; supply 0-5v output to a DFI MDM. There are up to 4 measurements per SCU. USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05163100 (21) SGSC MR2 (A164)-100%	115	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05163200 (3) SGSC MR2 (A164)-100%	23	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05164 STRAIN GAGE SCU'S MR2 (A165)				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There are up to 4 measurements per SCU. USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05164100 (19) SGSC MR2 (A165)-100%	104	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05164200 (5) SGSC MR2 (A165)-100%	38	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05165 STRAIN GAGE SCU'S MR2 (A169)				FUNCTION: Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There are up to 4 measurements per SCU. USAGE: The WBM SGSC's are on during ascent, OMS burns, and descent. The 100% SGSC's are on continuously throughout all OFT flights. ANALYSIS USAGE:
05165100 (13) SGSC MR2 (A169)-100%	71	0077	117	OFT - On from pwr xfr int to EOM

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05165200 (4) SGSC MR2 (A169)-WBM	31	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 prior to deorbit until EOM OPS - N/A
05165300 (3) SGSC MR2 (A169)-WBM	23	0077	051,103,109, 301,401,433	STS-1 - Same as 05165200 STS-2 - Same as 05165200 OPS - N/A
05165400 (4) SGSC MR2 (A169)-100%	31	0077	117	OFT - On from pwr xfr into to EOM OPS - N/A
05166 STRAIN GAGE SCU'S ML3 (A166)				FUNCTION: Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There are up to 4 measurements per SCU. USAGE:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				The WBM SGSC's are on during ascent, OMS burns, and descent. The 100% SGSC's are on continuously throughout all OFT flights. The spare SGSC's are not used.
				ANALYSIS USAGE:
05166100 (14) SGSC ML3 (A166)-100%	76	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05166200 (4) SGSC ML3 (A166)-WBM	31	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM OPS - N/A
05166300 (4) SGSC ML3 (A166)-SPRS	31	0077	None	OFT - Not used OPS - N/A
05166400 SGSC ML3 (A167)-SPRS	8	0077	None	OFT - Not used OPS - N/A
05167 STRAIN GAGE SCU'S ML3 (A167)				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide power and signal conditioning for strain gages; supply a 0-5v output to a DFI MDM. There are 4 measurements per SCU.
				USAGE:
				The WBM SGSC's are on during ascent, OMS burns, and descent. The 100% SGSC's are on continuously throughout all OFT flights.
				ANALYSIS USAGE:
05167100 (11) SGSC ML3 (A167)-100%	60	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05167200 (6) SGSC ML3 (A167)-WBM	46	0077	051,103,109, 301,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, from 30 min prior to until 30 min after the rehearsal deorbit, and from 30 min prior to deorbit until EOM
				STS-2 - On from pwr xfr int to OMS-2 plus 30 min, from 5 min prior to each OMS burn until the end of the burn, and from 30 min prior to deorbit until EOM
				OPS - N/A
05167300 (3) SGSC ML3 (A167)-100%	23	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05170 MDM FWD				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Accepts up to 192 discrete (5v or 28v) measurements, four 16-bit serial digital measurements and 352 signal conditioned analog (0-5v) measurements. The analogs are digitized and each measurement is clocked out to the DFI PCMMU upon request.
				USAGE:
				On continuously throughout all OFT flights.
				ANALYSIS USAGE:
05170000 MDM DF1 - FWD	54	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05180 MDM'S MID				FUNCTION:
				Accept up to 192 discrete (5v or 28v) measurements, four 16-bit serial digital measurements, and 352 analogs are digitized and each measurement is clocked out to a PCMMU upon request (DC1 to the OFI PCMMU, remainder to DFI PCMMU).
				USAGE:
				All on continuously throughout all OFT flights.
				ANALYSIS USAGE:
05180100 MDM DL1 - MID LEFT 1	50	0077	117	OFT - On from pwr xfr int to EOM
				OPS - N/A
05180200 MDM DL2 - MID LEFT 1	50	0077	117	OFT - On from pwr xfr int to EOM

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05180300 MDM DR1 - MID RGHT 2	50	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05180400 MDM DR2 - MID RGHT 2	53	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05180500 MDM DC1 - MID LEFT 3	49	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05180600 MDM DC2 - MID LEFT 3	52	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05190 S-BND FM XMTR-DFI				FUNCTION: Provides an S-Band RF Carrier and modulates it with the 1.024 MHz subcarrier from fwd FDM #1 for S-Band downlink. This provides a downlink of the DFI PCM and 15 channels of the DFI wideband system. There is no capability for ground command control of this component. USAGE: On continuously throughout all OFT flights.

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	FFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
05190000 S-BND FM XMTR-DFI	120	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05210 S-BAND DFI COAX SW				FUNCTION: Provides the capability of selecting which operational S-Band FM Xmtr is to be multiplexed with the DFI S-Band FM Xmtr for downlink. On OV-102 OFT only. USAGE: Momentary only.
				ANALYSIS USAGE:
05210000 S-BAND DFI COAX SW	6	0077	None	OFT - Not used (momentary power) OPS - N/A
05220 ARS DFI SIGNAL COND				FUNCTION: Provides signal conditioning for water and air flow instrumentation. USAGE: On continuously throughout all OFT flights.
				ANALYSIS USAGE:
05220000 ARS DFI SIGNAL COND	6	0077	117	OFT - On from pwr xfr int to EOM

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05230 ATCS DFI SIGNAL COND				FUNCTION: Provides signal conditioning for the ATCS DFI. USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05230000 ATCS DFI SIGNAL COND	2	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05240 DFI FREON PUMPS				FUNCTION: Supply coolant flow for cooling the DFI electronics in the mid-body area. The two pumps are redundant. USAGE: One on continuously throughout all OFT flights. ANALYSIS USAGE:
05240100 DFI FREON PUMP #1	234	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05240210 DFI FREON PUMP #2	233	0077	None	OFT - Not used (redundant equipment)

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05250 3-AXIS ACCEL				FUNCTION: Measures acceleration along three mutually perpendicular axes. USAGE: On continuously throughout all OFT flights. ANALYSIS USAGE:
05250000 3-AXIS ACCEL	2	0077	117	OFT - On from pwr xfr int to EOM OPS - N/A
05290 CAMERAS (DATA & SURVEILLANCE)				FUNCTION: Photograph the separation of the SRB from the ET, and ET from Orbiter. USAGE: All three cameras operate simultaneously at two separate times, between SRB SEP FIRE CMD -6 sec to sep + 4 sec, and MECO + 7 sec to MECO + 1 min 17 sec. ANALYSIS USAGE:
05290100 DATA CAM #1 (ASCENT)	84	0077	203,205	OFT - On for 10 sec at approx L/off + 1 min 55 sec and on for 70 sec at MECO + 7 sec OPS - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05290200 DATA CAM #2 (ET SEP)	84	0077	203,205	OFT - Same as 05290100 OPS - N/A
05290300 SURVEILLANCE CAMERA	84	0077	203,205	OFT - Same as 05290100 OPS - N/A
05300 PAO CAMERAS				FUNCTION: Provide a multi-purpose 16mm photography capability for photographing payload/payload bay functions and various other items of interest. The cameras utilize 145 ft film magazines. The magazines have a run time which varies from 3.25 min at 24 fps to 40 min at 2 fps. USAGE: Complete usage of the 12 film magazines at a worst case frame rate of 2 fps would result in a total camera run time of 8.0 hrs. Camera usage will be spread over an entire mission and will not be confined to any specific time period. Both cameras, however, are expected to be on for 13 min during both ascent and descent. ANALYSIS USAGE:
05300100 PAO CAMERA - LH WIND	28	0077	103,509	OFT - On from 30 sec prior to liftoff until 12 min 30 sec GET, on from 12 min prior to touchdown until 1 min after touchdown

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05300200 PAO CAMERA - CREW	28	0077	103,509	OFT - Same as 05300100 OPS - N/A
05350 IECM ELECTRONICS				FUNCTION: Measures deposition, off-gassing, and various particle densities in the payload bay and bay local environments. USAGE: During ascent and descent operations uses its own battery power; during on-orbit operations uses Orbiter's power. ANALYSIS USAGE:
05350000 IECM ELECTRONICS	150	0077	105	OFT - On from OMS-2 to deorbit OPS - N/A
05360 RELEASE ENGAGE MECHANISM (REM) MOTORS				FUNCTION: Engages (releases) the IECM package to (from) the top of the DFI pallet. The no. 2 motor is redundant and only used in event of a failure. USAGE: One REM motor will be on to engage (release) the

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				IECM package to (from) the top of the DFI pallet. Estimated engage/release time is 20 sec maximum. No usage anticipated on STS-1 and STS-2.
				ANALYSIS USAGE:
05360100 REM MOTOR #1	450	0077	None	STS-1 - Not used
				STS-2 - Not used
				OPS - N/A
05360210 REM MOTOR #2	450	0077	None	OFT - Not used (redundant equipment)
				OPS - N/A
05370 PLDBAY DAC CAMERAS				FUNCTION:
				Film payload bay activities
				USAGE:
				Used to supplement payload bay TV cameras as required.
				ANALYSIS USAGE:
05370100 PLB CAM FWD HT-CNTR	28	0037	455	STS-1 - N/A
				STS-2 - On during payload bay TV activities with a 10% usage factor
				OPS - N/A
05370200 PLB CAM FWD MID-PORT	28	0037	455	STS-1 - N/A

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - Same as 05370100
				OPS - N/A
05370300 PLB CAM FWD LOW-PORT	28	0037	455	STS-1 - N/A
				STS-2 - Same as 05370100
				OPS - N/A
05370400 PLB CAM AFT HI-CNTR	28	0037	455	STS-1 - N/A
				STS-2 - Same as 05370100
				OPS - N/A
05370500 PLB CAM AFT MID-PORT	28	0037	455	STS-1 - N/A
				STS-2 - Same as 05370100
				OPS - N/A
05370600 PLB CAM AFT LOW-PORT	28	0037	455	STS-1 - N/A
				STS-2 - Same as 05370100
				OPS - N/A
05410 CAMERA HEATERS (DATA & SURVEILLANCE)				FUNCTION:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Maintain camera mechanism and film temperatures above 50 degrees F. USAGE: All heaters are armed during prelaunch cryogenic loading and remain armed until disabled 4 min 55 sec after MECO by the MPS Dump Sequence. ANALYSIS USAGE:
05410100 DATA CAMERA 1 HEATER	126	0077	Asc	OFT - See appendix B heater tables OPS - N/A
05410200 DATA CAMERA 2 HEATER	126	0077	Asc	OFT - See appendix B heater tables OPS - N/A
05410300 SURVEILLANCE CAM HTR	126	0077	Asc	OFT - See appendix B heater tables OPS - N/A
05420 PAO CAM HTRS				FUNCTION: Maintain camera temperatures above 0 degrees F. USAGE: Since all nominal camera usage is within the cabin, no heater usage is expected. ANALYSIS USAGE:
05420100				

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
PAO CAM HTR-LH WIND	22	0077	None	OFT - Not used OPS - N/A
05420200 PAO CAM HTR-CREW	22	0077	None	OFT Not used OPS - N/A
05470 IECM CNTL HTRS				FUNCTION: Provide an actively controlled environment for the IECM unit. USAGE: The IECM package is powered from its own battery during ascent and descent phases but utilizes Orbiter power while onorbit. The heaters are thermostatically controlled and continuously enabled. Estimated onorbit duty cycles are 50% for cold case. ANALYSIS USAGE:
05470100 IECM HEATER ZONE A	115	0077	600 series	OFT - See appendix B heater tables
05470200 IECM HEATER ZONE B	69	0077	600 series	OFT - See appendix B heater tables
05480 REM HEATER				FUNCTION: Used to heat the lubricant for the gears of the REM motors. USAGE:

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Thermostatically controlled. Other usage is TBD.
				ANALYSIS USAGE:
05480000 REM HEATER	90	0077	600 series	STS-1 - Not used STS-2 - See appendix B heater tables OPS - N/A
05490 PLDBAY DAC CAMERA HEATERS				FUNCTION: Provide a controlled thermal environment for the payload data acquisition cameras. USAGE: Heater usage is primarily a function of attitude. It is estimated that heater duty cycles are 25% for warm case and 50% for cold case. No usage is expected during camera operation.
				ANALYSIS USAGE:
05490100 PLB CAM HT-FD HI CTR	22	0037	600 series	STS-1 - N/A STS-2 - See appendix B heater tables OPS - N/A
05490200 PLB CAM HT-FD MD PRT	22	0037	600 series	STS-1 - N/A STS-2 - Same as 05490100

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - N/A
05490300 PLB CAM HT-FD LO PRT	22	0037	600 series	STS-1 - N/A STS-2 - Same as 05490100 OPS - N/A
05490400 PLB CAM HT-AF HI CTR	22	0037	600 series	STS-1 - N/A STS-2 - Same as 05490100 OPS - N/A
05490500 PLB CAM HT-AF MD PRT	22	0037	600 series	STS-1 - N/A STS-2 - Same as 05490100 OPS - N/A
05490600 PLB CAM HT-AF LO PRT	22	0037	600 series	STS-1 - N/A STS-2 - Same as 05490100 OPS - N/A
05510 PCM MULTIPLEXER				FUNCTION: TBD Note: External tank DFI USAGE: TBD

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
05510000 PCM MULTIPLEXER	33	0077	203	ANALYSIS USAGE: OFT - On frm pwr xfr int to MECO OPS - N/A
05520 FM MULTIPLEXER				FUNCTION: TBD Note: External Tank DFI USAGE: TBD
05520000 (4) FM MULTIPLEXER	35	0077	203	ANALYSIS USAGE: OFT - On from pwr xfr int to MECO OPS - N/A
05521 FM MULTIPLEXER				FUNCTION: TBD USAGE: TBD
05521000 FM MULTIPLEXER	13	0077	203	ANALYSIS USAGE: STS-1 - On from pwr xfr int to MECO OPS - N/A
05530 CHARGE AMPLIFIER				FUNCTION: TBD Note: External Tank DFI USAGE: TBD

TABLE A-V.- DEVELOPMENT FLIGHT INSTRUMENTATION SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
05530000 (20) CHARGE AMPLIFIER	11	0077	203	OFT - On from pwr xfr int to MECO OPS - N/A
05540 LEVEL SENSOR ELECT				FUNCTION: TBD Note: External Tank DFI USAGE: TBD
				ANALYSIS USAGE:
05540000 LEVEL SENSOR ELECT	46	0077	203	OFT - On from pwr xfr int to MECO OPS - N/A
05550 PRESSURE MEASUREMENT				FUNCTION: TBD Note: External Tank DFI USAGE: TBD
				ANALYSIS USAGE:
05550000 (25) PRESSURE MEASUREMENT	9	0077	203	OFT - On from pwr xfr int to MECO OPS - N/A

A-VI 0600
EP & DC

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06010 INVERTERS				FUNCTION: Convert dc power to 115v, 400 Hz ac power. The inverters are rated at 750 volt-amps and have an average efficiency of approximately 76.5%. The nine inverters constitute three 3-phase ac systems. USAGE: On continuously throughout all missions. Note: The inverters are considered to be zero power devices. The power requirements of components which receive power from the inverters, however, must be reflected back through the inverters, by means of their efficiency (i.e. Pout = Eff x Pin).
06010100 INVERT ARRAY 1 PH-A	0	7677	None	ANALYSIS USAGE: Not used (low power) Note: The power dissipated by this assembly is included in the Shuttle Operational Data Book (SODB) efficiency data (sec. 4.5.6.3.1.7) and is, therefore, included in the SEPS program inverter model.
06010200 INVERT ARRAY 1 PH-B	0	7677	None	Same as 06010100
06010300 INVERT ARRAY 1 PH-C	0	7677	None	Same as 06010100
06010400 INVERT ARRAY 2 PH-A	0	7677	None	Same as 06010100

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06010500 INVERT ARRAY 2 PH-B	0	7677	None	Same as 06010100
06010600 INVERT ARRAY 2 PH-C	0	7677	None	Same as 06010100
06010700 INVERT ARRAY 3 PH-A	0	7677	None	Same as 06010100
06010800 INVERT ARRAY 3 PH-B	0	7677	None	Same as 06010100
06010900 INVERT ARRAY 3 PH-C	0	7677	None	Same as 06010100
06020 LEFT MIDBODY PYRO-TECHNIC CONTROLLER				FUNCTION: Operates in conjunction with the GPC's to control the pyrotechnic devices used to jettison payload bay equipment, in the event of a contingency. A jettison capability is provided for all equipment which could preclude the closing of the PLB doors (e.g. manipulators, docking ring, etc.). There is one baseline controller, but two additional controllers may be installed, in the midbody area, if necessary to extend the jettison capability. USAGE: On during contingencies which require PLB equipment to be jettisoned. ANALYSIS USAGE:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06020000 LH MBDY JET CNTL ASY	10	7677	None	Not used (contingency usage)
06030 MASTER EVENT CONTROLLER				FUNCTION: Provide command and fire signals, under GPC control, to the aft pyrotechnic devices used for T-0 umbilical release, hold down bolt release, ET umbilical disconnect, ET separation, and SRB separation. The controllers are redundant. USAGE: Both controllers are required to be on from prelaunch through ET separation. They may be manually deactivated anytime after ET separation. The ET SEP mode represents the power drawn during ET separation, for a duration of 2 sec nominally. ANALYSIS USAGE:
06030100 MEC #1 - AVERAGE	84	7677	103,401	On from pwr xfr int to OMS-2 c/off plus 20 min 14 sec
06030110 MEC #1 - ET SEP	210	7677	None	Not used (momentary power)
06030200 MEC #2 - AVERAGE	84	7677	103,401	On from pwr xfr int to OMS-2 c/off plus 20 min 14 sec
05030210 MEC #2 - ET SEP	210	7677	None	Not used (momentary power)
06090 GROUND COMMAND INTERFACE UNITS				FUNCTION:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide ground command capability to control various Orbiter communication and instrumentation functions. The units are redundant.
				USAGE:
				One on continuously throughout all missions.
				ANALYSIS USAGE:
06090100 GCIL CONTROLLER A	30	7677	101	On from pwr xfr int to EOM
06090200 GCIL CONTROLLER B	30	7677	None	Not used (redundant equipment)
06100 INVERTER DISTRIBUTION & CONTROL ASSEMBLIES				FUNCTION:
				Provide control of inverter to ac bus connection, ac bus over/under voltage monitoring, and auto disconnect logic.
				USAGE:
				All on continuously throughout all missions.
				ANALYSIS USAGE:
06100100 INV DIST/CTL ASY1-DC	1	7677	None	Not used (low power)
06100200 INV DIST/CTL ASY1-AC	2	7677	101	On from pwr xfr int to EOM
06100300 INV DIST/CTL ASY2-DC	1	7677	None	Not used (low power)

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06100400 INV DIST/CTL ASY2-AC	2	7677	101	On from pwr xfr int to EOM
06100500 INV DIST/CTL ASY3-DC	1	7677	None	Not used (low power)
06100600 INV DIST/CTL ASY3-AC	2	7677	101	On from pwr xfr int to EOM
06170 DC CURRENT SENSORS				FUNCTION: Provides the capability of measuring the current flowing to each of the main buses, the payload aft feeds, and the air data probe. USAGE: All on continuously throughout all missions. ANALYSIS USAGE:
06170100(3) CURR SENSOR-MIDBDY 1	3	7677	101	On from pwr xfr int to EOM
06170200(3) CURR SENSOR-MIDBDY 2	3	7677	101	Same as 06170100
06170300(3) CURR SENSOR-MIDBDY 3	3	7677	101	Same as 06170100
06170400 CURR SENSOR-PL MNB	1	7677	None	Not used (low power)
06170500 CURR SENSOR-PL MNC	1	7677	None	Not used (low power)

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06170600 CURR SENSOR-LH ADP	1	7677	None	Not used (low power)
06170700 CURR SENSOR-LH ADP	1	7677	None	Not used (low power)
06170800 CURR SENSOR-RH ADP	1	7677	None	Not used (low power)
06170900 CURR SENSOR-RH ADP	1	7677	None	Not used (low power)
06180 H202 CRYO CONTROL ASSEMBLIES				FUNCTION: Control the cryogenic heaters based on tank pressure switches. The assemblies contain circuitry for 02 heater protective devices and for heater "on" talkbacks. There is one assembly per H2/02 tank set. Assemblies 1 and 2 are interconnected in such a manner that both 02 heaters operate in unison and both H2 heaters operate in unison. The third, cryo tank assembly, will operate independently. When additional tanks are added, they will operate in pairs with any left over tank set operating independently. USAGE: Each controller operates continuously at the quiescent power level. The cyclic power level is an incremental increase to this level, the duty cycle of which is a function of cryo heater operation (see 31170, 31180, and 31190). ANALYSIS USAGE:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06180100 H202 CRYO ASY 1A-QUES	12	7677	101	On from pwr xfr int to EOM
06180200 H202 CRYO ASY 1B-QUES	12	7677	101	On from pwr xfr int to EOM
06180300 H202 CRYO ASY1A-H2CY	7	7677	475	Cycles concurrently with the cryo H2 tank 1 heater A. See 31190100 and appendix B
06180400 H202 CRYO ASY1B-H2CY	7	7677	479	Cycles concurrently with the cryo H2 tank 1 heater B. See 31190200 and appendix B
06180500 H202 CRYO ASY1A-02CY	25	7677	467	Cycles concurrently with the cryo 02 tank 1 A1 and A2 heaters. See 31170100, 31170200, and appendix B
06180600 H202 CRYO ASY1B-02CY	25	7677	471	Cycles concurrently with the cryo 02 tank 1 B1 and B2 heaters. See 31180100, 31180200, and appendix B
06181 H202 CRYO CONTROL ASSEMBLIES				FUNCTION: See 06180 USAGE: See 06180 ANALYSIS USAGE:
06181100 H202 CRYO ASY2A-QUES	12	7677	101	On from pwr xfr int to EOM
06181200 H202 CRYO ASY2B-QUES	12	7677	101	On from pwr xfr int to EOM
06181300 H202 CRYO ASY2A-H2CY	7	7677	477	Cycles concurrently with the cryo H2 tank 2 heater A.

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				See 31190300 and appendix B
06181400 H202 CRYO ASY2B-H2CY	7	7677	481	Cycles concurrently with the cryo H2 tank 2 heater B. See 31190400 and appendix B
06181500 H202 CRYO ASY2A-O2CY	25	7677	469	Cycles concurrently with the cryo O2 tank 2 A1 and A2 heaters. See 31170300, 31170400 and appendix B
06181600 H202 CRYO ASY2B-O2CY	25	7677	473	Cycles concurrently with the cryo O2 tank 2 B1 and B2 heaters. See 31180300, 31180400 and appendix B
06182 H202 CRYO CONTROL ASSEMBLIES				FUNCTION: See 06180 USAGE: See 06180 ANALYSIS USAGE:
06182100 H202 CRYO ASY3A-QUES	12	7637	101	STS-1 - N/A STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to EOM
06182200 H202 CRYO ASY3B-QUES	12	7637	101	STS-1 - N/A STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to EOM
06182300 H202 CRYO ASY3A-H2CY	7	7637	487	STS-1 - N/A

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - Cycles concurrently with the cryo H2 tank 3 heater A. See 31190500 and appendix B OPS - Cycles concurrently with the cryo H2 tank 3 heater A. See 31190500 and appendix B
06182400 H202 CRYO ASY3B-H2CY	7	7637	489	STS-1 - N/A STS-2 - Cycles concurrently with the cryo H2 tank 3 heater B. See 31190600 and appendix B OPS - Cycles concurrently with the cryo H2 tank 3 heater B. See 31190600 and appendix B
06182500 H202 CRYO ASY3A-02CY	25	7637	483	STS-1 - N/A STS-2 - Cycles concurrently with the cryo 02 tank 3 A1 and A2 heaters. See 31170500, 3170600 and appendix B OPS - Cycles concurrently with the cryo 02 tank 3 A1 and A2 heaters. See 31170500, 31170600 and appendix B
06182600 H202 CRYO ASY3B-02CY	25	7637	485	STS-1 - N/A STS-2 - Cycles concurrently with the cryo 02 tank 3 B1 and B2 heaters. See 31180500, 31180600 and appendix B OPS - Cycles concurrently with the cryo 02 tank 3 B1 and B2 heaters. See 31180500, 31180600 and appendix B

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06200 PROX SENSOR ELECTRONICS PKGS				FUNCTION: Provide discrete signals of landing gear status for TM, crew display, flight control input, and sequencing. The signals provided include: Uplock and downlock for RMG, LMG, and NLG; weight on wheels for RMG, LMG, and NLG; and NLG Door Uplock. USAGE: Both on from launch through OMS-2 and from pre-deorbit checkout until deactivated by the crew after stoproll. ANALYSIS USAGE:
06200100 PROX SNSR EL PKG #1	8	7677	103,109,433	STS-1 - On from pwr xfr int through OMS-2, from 4.0 hrs prior to until rehearsal deorbit, and from 4.0 hrs prior to deorbit until EOM STS-2 - On from pwr xfr int through OMS-2, and from 4.0 hrs prior to deorbit until EOM OPS - On from pwr xfr int through OMS-2, and from 1.0 hr prior to deorbit until EOM
06200200 PROX SNSR EL PKG #2	8	7677	103,109,433	STS-1 - On from pwr xfr int through OMS-2, from 4.0 hrs prior to until rehearsal deorbit, and from 4.0 hrs prior to deorbit until EOM STS-2 - On from pwr xfr int through OMS-2, and from 4.0 hrs prior to deorbit until EOM OPS - On from pwr xfr int through OMS-2, and from 1.0 hr prior to deorbit to EOM

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

06210
MOTOR CONTROL
ASSEMBLIES - FORWARD

FUNCTION:

Provide ac motor power switching and control logic for the following bi-directional motor controlled devices: air data probes, forward RCS isolation valves, star-tracker doors, and forward vent doors. The units contain drivers, hybrid relays (built-in drivers), fuses, diodes, and resistors.

USAGE:

On continuously throughout all missions. The power consumed by each assembly is a function of the number of active drivers and energized relays within that assembly. The operational duty cycles are small, such that the continuous power can be considered to be the driver requirements at "idle". Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
All drivers & relays active[1]	45.4	45.9	49.9
Maximum (STS-1)[2]	4.0	3.7	5.1
Average (STS-1)[2]	4.0	3.7	5.1
Minimum[1]	3.1	2.7	4.2

Note: 1 = MAGIC program output;
2 = MAGINT program output.

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
06210100 MTR CNTL ASSY FWD #1	27	7677	101	On with a 15.0% usage factor from pwr xfr int to EOM
06210200 MTR CNTL ASSY FWD #2	30	7677	101	On with a 12.5% usage factor from pwr xfr int to EOM
06210300 MTR CNTL ASSY FWD #3	27	7677	101	On with a 18.9% usage factor from pwr xfr int to EOM
06220 MOTOR CONTROL ASSEMBLIES - MID				FUNCTION:
				Provide ac motor power switching and control logic for the following bi-directional motor controlled devices: payload bay door latches and deploy mechanism, radiator, payload latches, manipulator arm, rendezvous radar, and mid area vents. The units contain drivers, hybrid relays (built-in drivers), fuses, diodes and resistors.
				USAGE:
				On continuously throughout all missions. The power consumed by each assembly is a function of the number of active drivers and energized relays within that assembly. The operational duty cycles are small, such that the continuous power can be considered to be the driver requirements at "idle". Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)			
	1	2	3	4
All drivers & relays active[1]	173.0	162.8	134.6	221.7

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Maximum (STS-1)[2] 56.0 47.2 45.25 65.2
				Average (STS-1)[2] 12.3 12.7 10.7 12.5
				Minimum[1] 11.1 11.8 9.4 11.1
				Note: 1 = MAGIC program output; 2 = MAGINT program output.
				ANALYSIS USAGE:
06220100 MTR CNTL ASSY MID #1	54	7677	101	On with a 22.8% usage factor from pwr xfr int to EOM
06220200 MTR CNTL ASSY MID #2	94	7677	101	On with a 13.5% usage factor from pwr xfr int to EOM
06220300 MTR CNTL ASSY MID #3	53	7677	101	On with a 20.2% usage factor from pwr xfr int to EOM
06220400 MTR CNTL ASSY MID #4	95	7677	101	On with a 13.2% usage factor from pwr xfr int to EOM
06230 MOTOR CONTROL ASSEMBLIES - AFT				FUNCTION:
				Provide ac motor power switching and control logic for the following bi-directional motor controlled devices: ET umbilical doors, OMS/RCS valves, and aft vents. The units contain drivers, hybrid relays (built-in drivers), fuses, diodes, and resistors.
				USAGE:
				On continuously throughout all missions. The power consumed by each assembly is a functon of the number

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				of active drivers and energized relays within that assembly. Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
All drivers & relays active[1]	130.5	115.5	178.4
Maximum (STS-1)[2]	29.0	24.1	28.3
Average (STS-1)[2]	9.0	8.5	15.3
Minimum[1]	7.7	7.2	13.7

Note: 1 = MAGIC program output;
2 = MAGINT program output.

				ANALYSIS USAGE:
06230100 MTR CNTL ASSY AFT #1	45	7677	101	On with a 20.0% usage factor from pwr xfr int to EOM
06230200 MTR CNTL ASSY AFT #2	41	7677	101	On with a 20.7% usage factor from pwr xfr int to EOM
06230300 MTR CNTL ASSY AFT #3	50	7677	101	On with a 30.6% usage factor from pwr xfr int to EOM
06240 LOAD CONTROL ASSEMBLIES - FORWARD				FUNCTION:
				Provide drivers to power forward loads less than 5.0 amps. The assemblies contain drivers, PIC's, diodes, fuses, and certain power switching logic circuits associated with the forward PCA's. Each LCA contains 150-200 drivers. Forward LCA's 1, 2, and 3 control

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

power from buses A, B, and C, respectively.

USAGE:

On continuously throughout all missions. The power consumed by each LCA is a function of the number of active drivers within that LCA. Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
All drivers & relays active[1]	60.9	93.5	54.2
Maximum (STS-1)[2]	25.5	38.2	35.1
Average (STS-1)[2]	24.4	35.0	27.1
Minimum (STS-1)[2]	23.8	34.6	27.0

	POWER (Watts)		
	1	2	3
No drivers active[1]	22.5	23.4	24.6

Note: 1 = MAGIC program output;
2 = MAGINT program output.

ANALYSIS USAGE:

06240100 LOAD CNTL ASSY FWD 1	90	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Prelaunch 26.8
				Lift-off to SRB separation 26.0
				SRB separation to OMS-2 26.3
				OMS-2 to deorbit 28.0
				Deorbit to stoproll 27.8
				Stoproll to EOM 26.8
				Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit.
				STS-2 - Same as STS-1
				OPS - On with a 27.1% usage factor from pwr xfr int to EOM
06240200 LOAD CNTL ASSY FWD2	90	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	30.5
Lift-off to MECO	29.8
MECO to insertion	29.7
Insertion to OMS-2	31.8
OMS-2 to deorbit	30.6

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Deorbit to 400,000 feet 32.0 400,000 feet to stoproll 32.0 Stoproll to EOM 32.5 Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit STS-2 - Same as STS-1 OPS - On with a 30.8% usage factor from pwr xfr int to EOM
06240300 LOAD CNTL ASSY FWD3	90	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows: Phase — UF(%)[1] Prelaunch 37.8 Lift-off to SRB separation 38.1 SRB separation to insertion 30.1 Insertion to OMS-2 29.0 OMS-2 to deorbit 30.2 Deorbit to EOM 29.1 Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit STS-2 - Same as STS-1

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On with a 30.1% usage factor from pwr xfr int to EOM
06250 LOAD CONTROL ASSEMBLIES - AFT				FUNCTION: Provide drivers to power aft loads less than 5.0 amps. The assemblies contain drivers, diodes, fuses, and certain power switching logic circuits associated with the aft PCA's. Each LCA contains 200-250 drivers. Aft LCA's 1, 2, and 3 control power from buses A, B, and C, respectively. USAGE: On continuously throughout all missions. The power consumed by each LCA is a function of the number of active drivers within that LCA. Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
All drivers active[1]	393.3	384.9	341.4
Maximum (STS-1)[2]	151.5	140.4	150.2
Average (STS-1)[2]	82.1	79.1	86.0
Minimum (STS-1)[2]	69.2	63.3	76.2
No drivers active[1]	61.4	58.2	64.8

Note: 1 = MAGIC program output;

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				2 = MAGINT program output.
				ANALYSIS USAGE:
06250100 LOAD CNTL ASSY AFT1	288	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	42.2
Lift-off to SRB separation	38.8
SRB separation to MECO	31.1
MECO to insertion	32.1
Insertion to OMS-2	24.6
OMS-2 to deorbit	25.6

Phase	UF(%)[1]
Deorbit to 400,000 feet	26.3
400,000 feet to stoproll	25.8
Stoproll to EOM	27.00

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 26.0% usage factor from pwr xfr int to EOM

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
06250200 LOAD CNTL ASSY AFT2	270	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows: Phase — UF(%)[1] Prelaunch — 43.5 Lift-off to SRB separation — 38.6 SRB separation to MECO — 28.6 MECO to insertion — 30.0 Insertion to OMS-2 — 23.9 OMS-2 to deorbit — 27.5 Deorbit to 400,000 feet — 27.6 400,000 feet to stoproll — 26.1 Phase — UF(%)[1] Stoproll to EOM — 23.3 Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit STS-2 - Same as STS-1 OPS - On with a 27.8% usage factor from pwr xfr int to EOM
06250300 LOAD CNTL ASSY AFT3	234	7677	101,105,201, 203,205,211,	STS-1 - Usage factors are a function of mission phase, as follows:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			501,503,505	

Phase	UF(%)[1]
Prelaunch	53.3
Lift-off to SRB separation	44.4
SRB separation to MECO	27.9
MECO to insertion	21.5
Insertion to OMS-2	31.1
OMS-2 to deorbit	34.8
Deorbit to 400,000 feet	34.5
400 000 feet to stoproll	34.0
Stoproll to EOM	31.7

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 34.9% usage factor from pwr xfr int to EOM

06260
PWR CNTL ASSY'S FWD

FUNCTION:

Provide and control power to the respective forward Load Control Assemblies and other forward equipment. The assemblies contain RPC's, relays, latching contactors, diodes, and fuses. Forward PCA's 1, 2, and

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				3 control power from buses A, B, and C, respectively.
				Note: Forward PCA switching logic circuitry is contained within the forward LCA's (ref. 06240).
				USAGE:
				On continuously throughout all missions. The power consumed by each PCA is a functon of the number of active RPC's within that PCA. Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
All RPC's active[1]	296.6	225.9	259.5
Maximum (STS-1)[2]	166.8	135.3	137.0
Average (STS-1)[2]	117.0	118.8	98.0
Minimum (STS-1)[2]	112.0	114.8	92.0
No RPC's active[1]	34.9	37.5	34.3

Note: 1 = MAGIC program output;
2 = MAGINT program output.

ANALYSIS USAGE:

06260100 PCA FWD #1	326	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Phase / UF(%)[1]
				Prelaunch 21.7
				Lift-off to SRB separation 20.7
				SRB separation to MECO 22.2
				MECO to insertion 23.6
				Insertion to OMS-2 27.0
				OMS-2 to deorbit 30.0
				Deorbit to 400,000 feet 28.2
				400 000 feet to stoproll 27.7
				Stoproll to EOM 34.1
				Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit
				STS-2 - Same as STS-1
				OPS - On with a 29.7% usage factor from pwr xfr int to EOM
06260200 PCA FWD #2	326	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Phase / UF(%)[1]
				Prelaunch 22.7
				Lift-off to SRB separation 21.4
				SRB separation to MECO 22.1
				MECO to insertion 23.9
				Insertion to OMS-2 17.2
				OMS-2 to deorbit 12.7
				Deorbit to 400,000 feet 21.7
				400,000 feet to stoproll 16.4
				Stoproll to EOM 16.7
				Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit
				STS-2 - Same as STS-1
				OPS - On with a 13.2% usage factor from pwr xfr int to EOM
06260300 PCA FWD #3	326	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Phase	UF(%)[1]
Prelaunch	15.2
Lift-off to SRB separation	17.3
SRB separation to MECO	15.5
MECO to insertion	13.6
Insertion to OMS-2	14.0
OMS-2 to deorbit	13.9
Deorbit to 400,000 feet	11.1
400,000 feet to stoproll	12.3
Stoproll to EOM	24.7

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a usage factor of 13.9% from pwr xfr int to EOM

06270
PWR CNTL ASSY'S MID

FUNCTION:

Provide and control power to mid-body equipment including the essential buses, logic power for the Mid Motor Control Assemblies, power for the aft flight deck panels, and payload auxiliary power. The assemblies contain RPC's, relays, latching contactors, diodes, and fuses. Mid PCA's 1, 2, and 3 control

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				power from buses A, B, and C, respectively.
				USAGE:
				On continuously throughout all missions. The power consumed by each PCA is a function of the number of active RPC's within the PCA. Estimations, based upon the output of MPAD programs MAGIC and MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
All RPC's active[1]	376.4	331.6	147.0
Maximum (STS-1)[2]	87.5	74.6	47.8
Average (STS-1)[2]	68.5	62.4	37.0
Minimum (STS-1)[2]	65.8	60.9	35.4
No RPC's active[1]	41.5	40.0	34.7

Note: 1 = MAGIC program output;
2 = MAGINT program output.

ANALYSIS USAGE:

06270100 PCA MID #1	115	7677	101,103,105, 109,201,203, 205,211,501, 503,505	STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	41.3
Lift-off to SRB separation	41.5

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Phase	UF(%)[1]
SRB separation to MECO	40.9
MECO to insertion	41.0
Insertion to OMS-2	43.9
OMS-2 to deorbit	35.3
Deorbit to 400,000 feet	34.8
400,000 feet to stoproll	35.0
Stoproll to EOM	35.9

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 36.3% usage factor from pwr xfr int to EOM

06270200
PCA MID #2 — 115 — 7677 — 101,105,201, 203,205,211, 501,503,505

STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	31.6
Lift-off to SRB separation	32.1
SRB separation to MECO	23.8
MECO to insertion	24.0

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	FFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			503,505	

Phase	UF(%)[1]
Insertion to OMS-2	21.8
OMS-2 to deorbit	42.0
Deorbit to 400,000 feet	25.2
400 000 feet to stoproll	26.2
Stoproll to EOM	45.0

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 43.0% usage factor from pwr xfr int to EOM

06270300 PCA MID #3	115	7677	101,105,201, 203,205,211, 501,503,505	

STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	26.7
Lift-off to SRB separation	26.7
SRB separation to MECO	26.8
MECO to insertion	26.7
Insertion to OMS-2	26.8
OMS-2 to deorbit	28.4

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Phase	UF(%)[1]
Deorbit to 400,000 feet	26.7
400,000 feet to stoproll	26.6
Stoproll to EOM	25.0

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 29.1% usage factor from pwr xfr int to EOM

06280
PWR CNTL ASSY'S
AFT

FUNCTION:

Provide and control power to aft equipment. The assemblies contain RPC's, relays, latching contactors, diodes, and fuses. In addition, aft PCA's 4, 5, and 6 each contain a motor driven switch to control the connection of GSE power to the Orbiter main buses. Aft PCA's 1 and 4 control bus A power, 2 and 5 control bus B power, and 3 and 6 control bus C power.

Note: PCA switching logic circuitry is contained within the aft LCA's (ref. 06250).

USAGE:

On continuously throughout all missions. The power consumed by each PCA is a function of the number of active RPC's within that PCA. Estimations, based upon the output of MPAD programs MAGIC and MAGINT,

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

are as follows:

	POWER (Watts)					
	1	2	3	4	5	6
All RCP's active[1]	175.4	145.4	124.6	298.0	297.3	197.3
Maximum (STS-1)[2]	63.2	61.6	45.8	83.4	90.2	70.0

	POWER (Watts)					
	1	2	3	4	5	6
Average (STS-1)[2]	31.6	30.0	30.4	35.2	35.9	33.1
Minimum (STS-1)[2]	30.1	28.7	29.3	32.6	33.3	30.9
No RPC's active[1]	25.9	26.3	27.1	27.6	29.2	26.4

Note: 1 = MAGIC program output;
2 = MAGINT program output.

ANALYSIS USAGE:

06280100
PCA AFT #1 — 84 — 7677 — 101,105,201, 203,205,211, 501,503,505

STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	66.0
Lift-off to SRB separation	40.3
SRB separation to MECO	56.5
MECO to insertion	57.5
Insertion to OMS-2	37.1

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Phase	UF(%)[1]
OMS-2 to deorbit	34.6
Deorbit to 400,000 feet	50.8
400,000 feet to stoproll	32.8
Stoproll to EOM	28.5

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 35.8% usage factor from pwr xfr int to EOM

06280200
PCA AFT #2 | 84 | 7677 | 101,105,201, 203,205,211, 501,503,505

STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	46.6
Lift-off to SRB separation	25.0
SRB separation to MECO	36.9
MECO to insertion	40.5
Insertion to OMS-2	19.9
OMS-2 to deorbit	33.8
Deorbit to 400,000 feet	35.9

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE

Phase	UF(%)[1]
400,000 feet to stoproll	28.4
Stoproll to EOM	27.2

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 34.2% usage factor from pwr xfr int to EOM

06280300
PCA AFT #3 — 84 — 7677 — 101,105,201, 203,205,211, 501,503,505

STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	30.0
Lift-off to SRB separation	29.1
SRB separation to MECO	29.7
MECO to insertion	36.0
Insertion to OMS-2	20.4
OMS-2 to deorbit	30.9
Deorbit to 400,000 feet	26.2
400,000 feet to stoproll	28.2
Stoproll to EOM	29.0

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: 1 = Derived from MAGINT program using SEPS program 80 node circuit STS-2 - Same as STS-1 OPS - On with a 32.0% usage factor from pwr xfr int to EOM
06280400 PCA AFT #4	84	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	45.4
Lift-off to SRB separation	41.4
SRB separation to MECO	32.6
MECO to insertion	22.8
Insertion to OMS-2	33.6
OMS-2 to deorbit	30.7
Deorbit to 400,000 feet	44.9
400,000 feet to stoproll	35.0
Stoproll to EOM	47.6

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On with a 34.1% usage factor from pwr xfr int to EOM
06280500 PCA AFT #5	84	7677	101,105,201, 203,205,211, 501,503,505	STS-1 - Usage factors are a function of mission phase, as follows:

Phase	UF(%)[1]
Prelaunch	78.8
Lift-off to SRB separation	54.4
SRB separation to MECO	29.7
MECO to insertion	38.1
Insertion to OMS-2	32.2
OMS-2 to deorbit	35.9
Deorbit to 400,000 feet	37.8
400 000 feet to stoproll	39.6
Stoproll to EOM	57.4

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 39.8% usage factor from pwr xfr int to EOM

06280600 PCA AFT #6	84	7677	101,105,201,	STS-1 - Usage factors are a function of mission phase,

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			203,205,211, 501,503,505	as follows:

Phase	UF(%)[1]
Prelaunch	54.9
Lift-off to SRB separation	13.0
Separation to MECO	5.1
MECO to insertion	3.9
Insertion to OMS-2	4.9
OMS-2 to deorbit	22.7
Deorbit to 400,000 feet	17.7
400,000 feet to stoproll	18.4
Stoproll to EOM	44.1

Note: 1 = Derived from MAGINT program output using SEPS program 80 node circuit

STS-2 - Same as STS-1

OPS - On with a 24.9% usage factor from pwr xfr int to EOM

06290
MAIN DC DISTR &
CNTL ASSY'S

FUNCTION:

Interface with the fuel cells to form the main dc buses and distribute Orbiter dc power to panels,

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				power control assemblies, and payloads. The Distribution and Control Assemblies are located in the mid section. They contain motor driven switches, shunts, fuses, and diodes. The units control fuel cell to main bus connections and main bus ties, and provide bus feeder protection. Units #1 interfaces with fuel cell #1 and contains bus A. Unit #2 interfaces with fuel cell #2 and contains main bus B. Unit #3 interface with fuel cell #3 and contains main bus C.
				USAGE:
				On continuously throughout all missions. The power consumed by each assembly is a function of the bus power demand. Estimations based upon the output of MPAD program MAGINT, are as follows:

	POWER (Watts)		
	1	2	3
Maximum (STS-1)[1]	133.8	135.5	104.2
Average (STS-1)[1]	31.3	29.0	25.9
Minimum (STS-1)[1]	18.0	18.5	17.2

Note: 1 = MAGINT program output

				ANALYSIS USAGE:
06290100 MN DC DIST&CTL ASSY1	215	7677	None	Not used Note: The power dissipated by this assembly is included in the SEPS program EPDC model
06290200 MN DC DIST&CTL ASSY2	215	7677	None	Not used

TABLE A-VI.- ELECTRICAL POWER DISTRIBUTION AND CONTROL SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: The power dissipated by this assembly is included in the SEPS program EPDC model
06290300 MN DC DIST&CTL ASSY3	215	7677	None	Not used
				Note: The power dissipated by this assembly is included in the SEPS program EPDC model

A-VII 0700
DATA PROC.

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07010 GPC - CPU'S				FUNCTION: When in the run mode, GPC's operate in conjunction with their respective Input/Output processors (IOP's) to perform the data processing necessary to accomplish guidance, navigation and control; payload handling; and systems management. The GPC's individually, or in redundant sets, provide total control and monitoring of all Orbiter systems through the technique of loading various operating programs from Mass Memory Units. Communication between any GPC and the systems, Mass Memory Units, and other GPC's is accomplished through a network comprised of 24 data buses. When in the standby mode all IOP/CPU software activity is stopped except for cyclic monitor on the mode switch change. All IOP/CPU software activity is stopped and the GPC is in a hardware controlled state for the halt mode. Beginning with STS-3 selected GPC's will be turned off during orbital operations. USAGE: Run - All 5 in run mode for ascent through OMS-2 plus 20 min and from approximately 3 hrs prior to deorbit until post rollout. STS-1 orbital operations will use 3 in run mode. Subsequent mission orbital operations will use 2 in run mode, with a third added for RCS maneuvers, OMS burns, rendezvous, stationkeeping, docking, undocking, and for 30 min twice a day for updating. Standby - On STS-1, two computers will be in standby mode during orbital operations.

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Halt - On when the associated GPC is performing an initial program load (IPL). This is done whenever a computer which has been off is brought back on-line.
				ANALYSIS USAGE:
07010100 GPC CPU #1 - RUN	313	7677	101	On from pwr xfr int to EOM
07010110 GPC CPU #1 - STANDBY	308	7677	None	Not used
07010120 GPC CPU #1 - HALT	246	7677	None	Not used
07010200 GPC CPU #2 - RUN	313	7677	101	On from pwr xfr int to EOM
07010210 GPC CPU #2 - STANDBY	308	7677	None	Not used
07010220 GPC CPU #2 - HALT	246	7677	None	Not used
07010300 GPC CPU #3 - RUN	313	7677	051,103,109, 401,433	STS-1 - On from pwr xfr int to OMS-2 plus 20 min, from 4 hrs 30 min prior to until 30 min after the rehearsal deorbit, and from 4 hrs 30 min prior to deorbit until EOM STS-2 - On from pwr xfr int to OMS-2 plus 20 min, and from 4 hrs 30 min prior to deorbit until EOM OPS - On from pwr xfr int to OMS-2 plus 20 min and from 3 hrs prior to deorbit until EOM

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07010310 GPC CPU #3 - STANDBY	308	7677	051,107,401, 433	STS-1 - On from OMS-2 plus 20 min until 4 hrs 30 min prior to the rehearsal deorbit and from 30 min after the rehearsal deorbit until 4 hrs 30 min prior to deorbit STS-2 - On from OMS-2 plus 20 min until 4 hrs. 30 min prior to deorbit OPS - Not used
07010320 GPC CPU #3 - HALT	246	7677	None	Not used
07010400 GPC CPU #4 - RUN	313	7677	101,103,107, 109,313,401, 405,409,411, 413,433	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 30 min prior to OMS burns and RCS maneuvers through the post burn powerdown; on for station-keeping, docking, and undocking; on from 1 hr prior to NCC through the completion of rendezvous; on from 3 hrs prior to deorbit until EOM, also on for 30 min every 12 hrs from OMS-2 plus 1 hr until 3 hrs prior to deorbit
07010410 GPC CPU #4 - STANDBY	308	7677	None	Not used
07010420 GPC CPU #4 - HALT	246	7677	None	Not used
07010500 GPC CPU #5	313	7677	051,103,109, 307,401,433	STS-1 - On from pwr xfr int to OMS-2 plus 20 min, from 4 hrs 30 min prior to until 30 min after the deorbit rehearsal, and from 4 hrs 30 min prior

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				to deorbit until EOM, also on from 30 min prior to on-orbit OMS burns until 30 min after the burn STS-2 - On from pwr xfr int to OMS-2 plus 20 min, from 4 hrs 30 min prior to deorbit until EOM, and from 30 min prior to onorbit OMS burns until 30 min after the burn OPS - On from pwr xfr int to OMS-2 plus 20 min and from 3 hrs prior to deorbit until EOM
07010510 GPC CPU #5 - STANDBY	308	7677	051,107,401, 433	STS-1 - On from OMS-2 plus 20 min until 4 hrs 30 min prior to the rehearsal deorbit and from 30 min after the rehearsal deorbit until 4 hrs 30 min prior to deorbit, except when in the run mode STS-2 - On from OMS-2 plus 20 min until 4 hrs 30 min prior to deorbit, except when in the run mode OPS - Not used
07010520 GPC CPU #5 - HALT	246	7677	None	Not used
07020 GPC - IOP's				FUNCTION: When in the run mode the IOP's perform the Input/Output Processing to facilitate the run mode of the GPC Central Processing Units (CPU's) - See 07010. When in the standby/halt mode the IOP is on, but performing no processing. This mode is used in conjunction with the Standby and Halt modes of the GPC CPU's - See 07010. Beginning with STS-3, IOP's will be turned off when their respective GPC's are turned off during orbital operations.

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Run - On when the corresponding CPU's are in the Run mode.
				Standby/Halt - On when the corresponding CPU's are in either the Standby or the Halt mode.
				ANALYSIS USAGE:
07020100 GPC IOP #1 - RUN	340	7677	101	On from pwr xfr int to EOM
07020110 GPC IOP#1-STDBY/HALT	313	7677	None	Not used
07020200 GPC IOP #2 - RUN	340	7677	101	On from pwr xfr int to EOM
07020210 GPC IOP#2-STDBY/HALT	313	7677	None	Not used
07020300 GPC IOP #3 - RUN	340	7677	051,103,109, 401,433	STS-1 - Same as 07010300
				STS-2 - Same as 07010300
				OPS - On from pwr xfr int to OMS-2 plus 20 min and from 3 hrs prior to deorbit until EOM
07020310 GPC IOP#3-STDBY/HALT	313	7677	051,107,401, 433	STS-1 - Same as 07010310
				STS-2 - Same as 07010310
				OPS - Not used

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07020400 GPC IOP #4 - RUN	340	7677	101,103,107, 109,313,401, 405,409,411, 413,433	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 30 min prior to OMS burns and RCS maneuvers through the post burn powerdown; on for station-keeping, docking, and undocking; on from 1 hr prior to NCC through the completion of rendezvous; on from 3 hrs prior to deorbit until EOM; also on for 30 min every 12 hrs from OMS-2 plus 1 hr until 3 hrs prior to deorbit
07020410 GPC IOP#4-STDBY/HALT	313	7677	None	Not used
07020500 GPC IOP #5 - RUN	340	7677	051,103,109, 307,401,433	STS-1 - Same as 07010500 STS-2 - Same as 07010500 OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 3 hrs prior to deorbit until EOM
07020510 GPC IOP#5-STDBY/HALT	313	7677	051,107,401, 433	STS-1 - Same as 07010510 STS-2 - Same as 07010510 OPS - Not used
07030 MDM'S - FF				FUNCTION: Provide an interface between the GNC GPC's and the fwd GNC hardware. Each MDM provides conversion of analog

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				and discrete systems data to digital serial data for transfer to the GPC's and conversion of GPC commands into analog and discrete data for output to the systems. Equipment controlled and monitored includes: Nav Aids, Fwd RCS Thrusters, IMU's, hand controllers, and ADTA's. USAGE: All on continuously throughout the first STS mission. On subsequent missions two will be on continuously, while the remaining two will be powered only during ascent, descent, OMS burns, RCS maneuvers, rendezvous, stationkeeping, docking, and undocking. ANALYSIS USAGE:
07030100 MDM FF1	59	7677	101	On from pwr xfr int to EOM
07030200 MDM FF2	60	7677	101,103,109, 313,401,405, 409,411,413, 433	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 30 min prior to OMS burns and RCS maneuvers through the post burn powerdown; on for stationkeeping, docking, and undocking; on from 1 hr prior to NCC through the completion of rendezvous; on from 3 hrs prior to deorbit until EOM
07030300 MDM FF3	56	7677	101	On from pwr xfr int to EOM
07030400 MDM FF4	59	7677	101,103,109, 313,401,405,	STS-1 - On from pwr xfr int to EOM

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			409,411,413, 433	STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 30 min prior to OMS burns and RCS maneuvers through the post burn powerdown; on for stationkeeping, docking, and undocking; on from 1 hr prior to NCC through the completion of rendezvous; on from 3 hrs prior to deorbit until EOM
07040 MDM'S - FA				FUNCTION: Provide an interface between the GNC GPC's and the aft GNC hardware. Each MDM provides conversion of analog and discrete systems data to digital serial data for transfer to the GPC's and conversion of GPC commands into analog and discrete data for output to the systems. Equipment controlled and monitored includes: Aerosurfaces, Aft RCS Thrusters, OMS, and Rate Gyros. USAGE: All on continuously throughout the first STS mission. On subsequent missions two will be on continuously, while the remaining two will be powered only during ascent, descent, OMS burns, RCS maneuvers, rendezvous, stationkeeping, docking, and undocking. ANALYSIS USAGE:
07040100 MDM FA1	55	7677	101	On from pwr xfr int to EOM
07040200 MDM FA2	54	7677	101	On from pwr xfr int to EOM
07040300 MDM FA3	56	7677	101,103,109,	STS-1 - On from pwr xfr int to EOM

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			313,401,405, 409,411,413, 433	STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 30 min prior to OMS burns and RCS maneuvers through the post burn powerdown; on for stationkeeping, docking, and undocking; on from 1 hr prior to NCC through the completion of rendezvous; on from 3 hrs prior to deorbit until EOM
07040400 MDM FA4	56	7677	101,103,109, 313,401,405, 409,411,413, 433	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - On from pwr xfr int to OMS-2 plus 20 min; on from 30 min prior to OMS burns and RCS maneuvers through the post burn powerdown; on for stationkeeping, docking, and undocking; on from 1 hr prior to NCC through the completion of rendezvous; on from 3 hrs prior to deorbit until EOM
07090 MASS MEMORIES				FUNCTION: Provide magnetic tape storage for bulk data, GPC application programs, and display formats. The two units are redundant and each contains identical information. USAGE: Both on in Standby for all orbital operations and ascent. The "Operate" mode (tape moving) represents a very small fraction of total on time, a typical transaction consumes less than 1 min. Both in "Operate" approximately 5 times a day for 1 min each for updating.

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EPP	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
07090100 MM #1 TAPE OPER	78	7677	403	On for 1 min at the start of the crew workday
07090110 MM #1 TAPE STBY	20	7677	101	On from pwr xfr int to EOM
07090200 MM #2 TAPE OPER	78	7677	403	On for 1 min at the start of the crew workday
07090210 MM #2 TAPE STBY	20	7677	101	Same as 07090110
07100 MDM'S OFI				FUNCTION: Accept up to 192 discrete measurements (5v or 28v), four 16 bit serial digital measurements, and 352 signal conditioned analog measurements (0-5v). The analogs are digitized and each measurement is clocked out to the OFI PCMMU upon request. USAGE: All on continuously throughout all missions.
				ANALYSIS USAGE:
07100100 MDM OFI 1	47	7677	101	On from pwr xfr int to EOM
07100200 MDM OFI 2	47	7677	101	On from pwr xfr int to EOM
07100300 MDM OFI 3	47	7677	101	On from pwr xfr int to EOM

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07100400 MDM OFI 4 FLT DECK	40	7677	101	On from pwr xfr int to EOM
07110 MDM'S OAI				FUNCTION: Accept up to 192 discrete measurements (5v or 28v), and 352 signal conditioned analog measurements (0-5v). The analogs are digitized and each measurement is clocked out to the OFI PCMMU upon request. USAGE: All on continuously throughout all missions (see 40360). ANALYSIS USAGE:
07110100 MDM OAI 1	41	7677	101	On from pwr xfr int to EOM
07110200 MDM OAI 2	42	7677	101	On from pwr xfr int to EOM
07110300 MDM OAI 3	43	7677	101	On from pwr xfr int to EOM
07120 MDM LAUNCH FWD				FUNCTION: Acts as a command decoder to provide an interface between the LPS and/or GPC's and the Orbiter control panel switches to facilitate ground checkout activities. USAGE: Used during ground checkout activities. This component uses only GSE power.

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
07120000 MDM LF - 1 (GSE)	54	7677	None	Not used (GSE power)
07130 MDM LAUNCH AFT				FUNCTION: Acts as a command decoder to provide an interface between the LPS and/or GPC's and the Orbiter control panel switches to facilitate ground checkout activities. USAGE: Used during ground checkout activities. This component uses only GSE power.
				ANALYSIS USAGE:
07130000 MDM LA - 1 (GSE)	52	7677	None	Not used (GSE power)
07140 MDM'S-PAYLOAD (PL)				FUNCTION: Provides an interface between GPC's and comm equipment, Payloads, C&W, abort advisory, FCP, H_2O Loop Pump, and Hyd Sys Pump. USAGE: All on continuously throughout all missions.
				ANALYSIS USAGE:
07140100 MDM PL1	54	7677	101	On from pwr xfr int to EOM
07140200 MDM PL2	57	7677	101	On from pwr xfr int to EOM

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07150 ENG INTRFC UNITS				FUNCTION: Accept main engine commands from the GPC's and reformat them for transfer to the corresponding SSME controllers. They also accept data from the SSME controllers for routing to the LPS, the ops Recorders, and the S-Band FM telemetry system; and to the GPC's upon request. USAGE: On from 2.0 hrs prelaunch until the completion of SSME propellant dump (MECO plus 5 min). Turned off by the crew after insertion. ANALYSIS USAGE:
07150100 ENG INTRFC UN #1	49	7677	103,401	On from pwr xfr int to OMS-2 plus 20 min
07150200 ENG INTRFC UN #2	49	7677	103,401	On from pwr xfr int to OMS-2 plus 20 min
07150300 ENG INTRFC UN #3	49	7677	103,401	On from pwr xfr int to OMS-2 plus 20 min
07160 DATA BUS ISO AMPS				FUNCTION: Isolate and buffer the interfaces between the GPC's and the LPS, and between the GPC's and the SRB's. Each amplifier contains two halves, one powered by the GSE and one by the Orbiter.

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				SRB Interface half - On from prelaunch until deactivated anytime after SRB separation (powered through MEC switches - see 06030). GSE Interface half - Powered by the GSE during ground testing only, not powered in flight.
				ANALYSIS USAGE:
07160100 DBIA #1 GSE-HI RATE	15	7677	None	Not used (GSE power)
07160110 DBIA #1 GSE STBY	11	7677	None	Not used (GSE power)
07160200 DBIA #1 SRB-HI RATE	15	7677	123	On from pwr xfr int until 2 min 5 sec after lift-off
07160210 DBIA #1 SRB STBY	11	7677	123,211,401	On from lift-off plus 2 min 5 sec to OMS-2 cutoff plus 20 min
07160300 DBIA #2 GSE-HI RATE	15	7677	None	Not used (GSE power)
07160310 DBIA #2 GSE STBY	11	7677	None	Not used (GSE power)
07160400 DBIA #2 SRB-HI RATE	15	7677	123	On from pwr xfr int until 2 min 5 sec after lift-off
07160410 DBIA #2 SRB STBY	11	7677	123,211,401	Same as 07160210

TABLE A-VII.- DATA PROCESSING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07500 GPC CNTLR PWR SUP'S				FUNCTION: Control which of the GPC's is physically selected as the Backup Flight Control Computer and, also, provides EMI filtering for the "Halt" signal from the computer mode switch. USAGE: Each is on when its corresponding GPC is on any mode. The relationship is as follows: GPC 1 — Controller 1 PSA GPC 2 — Controller 2 PSA GPC 3 — Controller 3 PSA GPC 4 — Controller 1 PSB GPC 5 — Controller 2 PSB ANALYSIS USAGE:
07500100 GPC CNTLR 1 PS A	7	0077	101	OFT - On from pwr xfr int to EOM OPS - N/A
07500200 GPC CNTLR 1 PS B	7	0077	101	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - N/A
07500300 GPC CNTLR 2 PS A	7	0077	101	OFT - On from pwr xfr int to EOM OPS - N/A

TABLE A-VII.- DATA PROCESSING SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
07500400 GPC CNTLR 2 PS B	7	0077	101	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - N/A
07500500 GPC CNTLR 3 PS A	7	0077	101	STS-1 - On from pwr xfr int to EOM STS-2 - On from pwr xfr int to EOM OPS - N/A
07500600 GPC CNTLR 3 PS B	1	0077	None	Not used (low power)

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P/L MAN & KITS

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08120 PSS-ASCENT				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08120020 PSS-ASCENT-AVG	350	7677	None	Not used (usage TBD)
08120030 PSS-ASCENT-PEAK	420	7677	None	Not used (usage TBD)
08121 PSS-ORBIT (DC)				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08121000 PSS-ORBIT (DC)	500	7677	None	Not used (usage TBD)
08122 PSS-ORBIT (AC)				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08122000 PSS-ORBIT (AC)	250	7677	None	Not used (usage TBD)
08130 PAYLOAD				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08130000				

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
PAYLOAD ASCENT (AVG)	1000	7677	None	Not used (usage TBD)
08130010 PAYLOAD ORBIT (AVG)	3000	7677	None	Not used (usage TBD)
08130020 PAYLOAD ORBIT (SL AV)	6731	7677	None	Not used (usage TBD)
08140 PAYLOAD-AUX POWER				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08140100 PAYLOAD-AUX POWER A	200	7677	None	Not used (usage TBD)
08140200 PAYLOAD AUX POWER B	200	7677	None	Not used (usage TBD)
08160 RH RMS				FUNCTION: Supplements the capabilities of the LH Manipulator (see 51010) to deploy, stow, and manipulate payloads. USAGE: Installed only when required by a particular payload. Only one of the manipulators may be active at one time (see 51010). ANALYSIS USAGE:
08160100 RH RMS - MOTORS	634	7600	None	Not used (usage TBD)
08160200				

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TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
RH RMS-ELECTRONICS	211	7600	None	Not used (usage TBD)
08160310 RH RMS-B/U ELECT	60	7600	None	Not used (usage TBD)
08170 RH RMS POSITION MTRS				FUNCTION: Deploy the kitted manipulator arm from the stowed to the operating position (outboard) and return it to the stowed position. The #1 and #2 motors are redundant but both are used together. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). All on for 34 sec to deploy the manipulator following PLB doors opening; all on for 34 sec to stow the manipulator just prior to PLB doors closing. A single motor at each location can deploy, or stow, the manipulator in 68 sec. Note: In general, the manipulator arm will be moved clear of the payload bay (i.e. to the outboard position) regardless of its planned usage. ANALYSIS USAGE:
08170100 RH RMS POSIT MTR 1	70	7600	435,437	OFT - N/A OPS - On for 34 sec at 7 min after the PLB Doors open initiation; on for 34 sec beginning 30 sec prior to PLB Doors close initiation (if installed).
08170200 RH RMS POSIT MTR 2	70	7600	435,437	OFT - N/A

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Same as 08170100
08180 RH MANIP RETENTION LATCH ACTUATORS				FUNCTION: Operate the latches which retain the manipulator arm to the deployment/retention mechanism during boost and entry. The #1 and #2 actuators are redundant, but both are used together. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). All on for 7.5 sec to unlatch prior to arm operation; all on for 7.5 sec to latch prior to stowing. A single actuator can operate the latch in 15 sec. ANALYSIS USAGE:
08180100 R MAN FWD RET LCH 1	60	7600	451,453	OFT - N/A OPS - On for 8 sec to unlatch the manipulator arm in preparation for operation; on for 8 sec to latch the manipulator arm in preparation for stowing (if installed)
08180200 R MAN FWD RET LCH 2	60	7600	451,453	OFT - N/A OPS - Same as 08180100
08180300 R MAN MID RET LCH 1	60	7600	451,453	OFT - N/A OPS - Same as 08180100

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08180400 R MAN MID RET LCH 2	60	7600	451,453	OFT - N/A OPS - Same as 08180100
08180500 R MAN AFT RET LCH 1	60	7600	451,453	OFT - N/A OPS - Same as 08180100
08180600 R MAN AF RET LCH 2	60	7600	451,453	OFT - N/A OPS - Same as 08180100
08190 RH RMS & EVA CAMERAS				FUNCTION: Provides the capability to monitor and transmit TV of payload bay activities. This camera is mounted on the RH Manipulator. For additional discussion see 02040. USAGE: Installed when payload requirements dictate a RH Manipulator (see 08160). Used in conjunction with the RH Manipulator to monitor payload handling, EVA's, etc.
08190100 TV CAM B&W-RRMS WRS	13	7600	451,453,455	ANALYSIS USAGE: OFT - N/A OPS - On during any scheduled manipulator operations or payload operations (if installed)

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08190200 TV CAM B&W-RRMS ELB	13	7600	451,453,455	OFT - N/A OPS - Same as 08190100
08190300 TV CAM COLR-KEEL EVA	13	7600	417	OFT - N/A OPS - On during any scheduled EVA
08191 RH RMS/EVA CAMERA LENS ASSEMBLIES				FUNCTION: Provides the capability to adjust zoom, focus, and iris on the B&W TV cameras. USAGE: Some power is required to maintain the B&W lens unit in a standby condition. The other B&W lens assembly motors are used as required during B&W camera operation to adjust zoom, focus, or iris. The color wheel motor on the color camera lens assembly operates continuously when the camera is on. The power consumed by this motor is represented by the standby mode. ANALYSIS USAGE:
08191100 B&W CAM LNS RRMS-SBY	1	7600	None	OFT - N/A OPS - Not used (low power)
08191110 B&W CAM LN RRMS-1MT	3	7600	None	Not used - Usage accounted for by motor #3

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08191120 B&W CAM LN RRMS-2MT	6	7600	None	Not used - Usage accounted for by motor #3
08191130 B&W CAM LN RRMS-3MT	8	7600	451,453,455	OFT - N/A OPS - On during any scheduled manipulator operations or payload operations (if installed) except at a 10% usage factor
08191200 B&W CAM LNS RRMS-SBY	1	7600	None	OFT - N/A OPS - Not used (low power)
08191210 B&W CAM LN RRMS-1MT	3	7600	None	Not used - Usage accounted for by motor #3
08191220 B&W CAM LN RRMS-2MT	6	7600	None	Not used - Usage accounted for by motor #3
08191230 B&W CAM LN RRMS-3MT	8	7600	451,453,455	OFT - N/A OPS - On during any scheduled manipulator operations or payload operations (if installed) except at a 10% usage factor
08191300 TV CAM EVA CL LN-SBY	5	7600	417	OFT - N/A OPS - On concurrently with camera 08190300
08191310 TV CAM EVA CL LN-1MT	8	7600	None	Not used - Usage accounted for by motor #3
08191320				

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
TV CAM EVA CL LN-2MT	11	7600	None	Not used - Usage accounted for by motor #3
08191330 TV CAM EVA CL LN-3MT	13	7600	417	OFT - N/A OPS - On during any scheduled EVA's except at a 10% usage factor.
08200 PAN TILT ASSY-RH RMS				FUNCTION: Provides the capability for the ground crew to remotely control pan and tilt of the B&W TV cameras on the right hand RMS. USAGE: Installed when payload requirements dictate a RH Manipulator (see 08160). Automatically powered whenever associated camera is on. It is estimated that peak power will be required approximately 20% of the time (while driving) and nominal power will be required about 80% of the time. Used in conjunction with the RH Manipulator to monitor payload handling. ANALYSIS USAGE:
08200000 PAN TLT ASY-RRMS SBY	1	7600	None	OFT - N/A OPS - Not used (low power)
08200010 PAN TLT ASY RRMS-1MT	3	7600	None	Not used - Usage accounted for by motor #2
08200020 PAN TLT ASY RRMS-2MT	6	7600	451,453,455	On concurrently with camera 08190100 except at a 10% usage factor.

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08210 RH RMS FLOODLIGHT				FUNCTION: Illuminates the working area of the effector for direct viewing and for TV. The light has individual on/off and continuous dimming controls. USAGE: Installed when payload requirements dictate a RH Manipulator (see 08160). Estimated usage is full-bright during manipulator operations.
08210000 RH RMS FLOODLIGHT	175	7600	451,453,455	ANALYSIS USAGE: OFT - N/A OPS - On during payload handling activities (if installed)
08220 RH RMS FLDLT VOLT BOOSTER				FUNCTION: Provides constant voltage and current to RH RMS floodlight. USAGE: Function of RH RMS floodlight usage.
08220000 RRMS FLDLT VOLT BSTR	25	7600	451,453,455	ANALYSIS USAGE: OFT - N/A OPS - On during payload handling activities (if installed)

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08230 COMSEC UNITS-PSS				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08230100 COMSEC UNIT #3-PSS	25	7677	None	Not used (usage TBD)
08230110 COMSEC UN #3(PSS)-STB	2	7677	None	Not used (usage TBD)
08230200 COMSEC UNIT #4-PSS	25	7677	None	Not used (usage TBD)
08230210 COMSEC UN #4(PSS)-STB	2	7677	None	Not used (usage TBD)
08240 MDM PF 3 KIT				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08240000 MDM PF 3 KIT	58	7677	None	Not used (usage TBD)
08250 OMS PBK CNTLS				FUNCTION: Control OMS PBK valves and heaters. The unit contains electronics for three increments of heaters, but only the number of increments being carried will function (see 08251). USAGE:

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Duty cycles will be the same as the thermostatically controlled PBK heaters, with the quiescent power being on the remainder of the time (see 08510).
				ANALYSIS USAGE:
08250100 OMS PBK CNT A INCR 3	216	7600	600 series	OFT - N/A OPS - Same as 08510120, see appendix B tables
08250210 OMS PBK CNT B INCR 3	216	7600	None	Not used (redundant equipment)
08250310 OMS PBK CT A I3-QUES	20	7600	101	OFT - N/A OPS - On from pwr xfr int to EOM, if three OMS kits are installed
08250410 OMS PBK CT B I3-QUES	20	7600	None	Not used (redundant equipment)
08250510 OMS PBK CNT A INCR 2	170	7600	600 series	OFT - N/A OPS - Same as 08510110, see appendix B tables
08250610 OMS PBK CNT B INCR 2	170	7600	None	Not used (redundant equipment)
08250710 OMS PBK CT A I2-QUES	16	7600	101	OFT - N/A OPS - On from pwr xfr int to EOM, if two OMS kits are installed
08250810				

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
OMS PBK CT B I2-QUES	16	7600	None	Not used (redundant equipment)
08250910 OMS PBK CNT A INCR1	131	7600	600 series	OFT - N/A OPS - Same as 08510100, see appendix B tables
08251 OMS PBK CNTLS				FUNCTION: Control OMS PBK valves and heaters. The unit contains electronics for three increments of heaters, but only the number of increments being carried will function (see 08250). USAGE: Duty cycles will be the same as the valves and thermostatically controlled PBK heaters, with the quiescent power being on the remainder of the time (see 08260, 08270, 08300, 08310, 08320, and 08510). ANALYSIS USAGE:
08251110 OMS PBK CNT B INCR1	131	7600	None	Not used (redundant equipment)
08251210 OMS PBK CT A I1-QUES	12	7600	101	OFT - N/A OPS - On from pwr xfr int to EOM, if one OMS kit is installed
08251310 OMS PBK CT B I1-QUES	12	7600	None	Not used (redundant equipment)
08251410 OMS PBK HE V CNT-OPR	4	7600	None	Not used

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08251510 OMS PBK HE V CT-QUES	1	7600	None	OFT - N/A OPS - Not used (very low power)
08251610 OMS PBK AC V CNT-OPR	3	7600	None	Not used
08251710 OMS PBK AC V CT-QUES	2	7600	101	OFT - N/A OPS - On from pwr xfr int to EOM, if one, two, or three OMS kits are installed
08260 VAP ISO VLVS PBK				FUNCTION: Allow He flow to pressurize the PBK oxidizer tank during OMS burns, and prevent propellant vapor mixing in the upstream system should propellant migration occur through the check valves, between OMS burns. They are normally closed solenoid valves, located downstream of the pressure equalization line in the oxidizer pressurization leg. They are opened by the "engine on" signal from the GPC when the OMS kit is selected for propellant feed, with manual override capability to either open or close. The valves are parallel but both are powered during OMS burns when the OMS kit is selected for propellant feed. USAGE: Installed when payload requirements dictate an OMS kit. Both valves are powered (open) for the full duration of each OMS burn when the kit is selected

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				for propellant feed (momentary power). The required actuation time is approximately 500 ms.
				ANALYSIS USAGE:
08260100 VAPOR ISO VLV #1 PBK	51	7600	None	Not used (momentary power)
08260200 VAPOR ISO VLV #2 PBK	51	7600	None	Not used (momentary power)
08270 HE ISO VLVS PBK				FUNCTION:
				Allow He flow to the PBK pressurization system during OMS burns and isolate the He tank from the two regulator legs of the pressurization system during non-thrusting periods. They are normally closed solenoid valves, opened by the "engine on" signal from the GPC when the OMS kit is selected for propellant feed, with manual override either open or closed. Both are powered during OMS burns when the OMS kit is selected for propellant feed.
				USAGE:
				Installed when payload requirements dictate an OMS kit. Both valves are powered (open) for the full duration of each OMS burn when the kit is selected for propellant feed (momentary power). The required actuation time is approximately 500 ms.
				ANALYSIS USAGE:
08270100 HE ISO VLV #1 PBK	73	7600	None	Not used (momentary power)
08270200 HE ISO VLV #2 PBK	73	7600	None	Not used (momentary power)

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08280 RIGHT MIDBODY PYRO-TECHNIC CONTROLLER				FUNCTION: Operate in conjunction with the GPC's to control the pyrotechnic devices used to jettison payload bay equipment, in the event of a contingency. A jettison capability is provided for all equipment which could preclude the closing of the PBL doors (e.g. manipulators, docking ring, etc.). There is one baseline controller (see 06020), but two additional controllers may be installed, in the midbody area, if necessary to extend the jettison capability. USAGE: Installed when payloads require additional jettison capability. On during contingencies which require PLB equipment to be jettisoned. ANALYSIS USAGE: Not used (contingency equipment)
08289000 RH MBDY JET CNTL ASY	10	7677	None	
08290 QUANTITY GAGES - PBK				FUNCTION: Sense the quantity remaining in each of the PBK propellant tanks. The signals are used for crew display and for a tank depletion indication to the GPC. These are capacitance probes. USAGE: Installed when payload requirements dictate an OMS kit.

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Operate Mode - On for the full duration of each OMS burn. Idle Mode - On continuously throughout the mission except when in operate. ANALYSIS USAGE:
08290000 QUANT GAGE PBK-OPER	30	7600	301,311	OFT - N/A OPS - On for the full duration of each OMS burn (if installed)
08290010 QUANT GAGE PBK-IDLE	10	7600	101	OFT - N/A OPS - On from pwr xfr to EOM except when in the operate mode (if installed)
08300 V POS INDS PBK				FUNCTION: TBD USAGE: TBD ANALYSIS USAGE:
08300100(4) VL PS IND PBK HE&VAP	2	7600	None	Not used (usage TBD)
08300200(8) VL PS IND PBK TK ISO	3	7600	101	OFT - N/A OPS - All on from pwr xfr int to EOM (if installed)
08310 OX TK ISO VLVS PBK				FUNCTION: (..ect the OMS kit to the crossfeed/interconnect

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				manifold to control propellant feed to the OMS engines from the OMS kit. These are motor driven ball valves requiring momentary power to open or close. Valves are in series/parallel.
				USAGE:
				Installed when payload requirements dictate an OMS kit. Normally closed, opened for OMS kit propellant usage (momentary power). The required actuation time is 500 ms.
				ANALYSIS USAGE:
08310100 OX TK ISO VLV A1 PBK	73	7600	None	Not used (momentary power)
08310200 OX TK ISO VLV A2 PBK	73	7600	None	Not used (momentary power)
08310300 OX TK ISO VLV B1 PBK	73	7600	None	Not used (momentary power)
08310400 OX TK ISO VLV B2 PBK	73	7600	None	Not used (momentary power)
08320 FU TK ISO VLVS PBK				FUNCTION:
				Connect the OMS kit to the crossfeed/interconnect manifold to control propellant feed to the OMS engines from the OMS kit. These are motor driven ball valves requiring momentary power to open or close. Valves are in series/parallel.
				USAGE:
				Installed when payload requirements dictate an OMS

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				kit. Normally closed, opened for OMS kit propellant usage (momentary power). The required actuation time is 500 ms.
				ANALYSIS USAGE:
08320100 FU TK ISO VLV A1 PBK	73	7600	None	Not used (momentary power)
08320200 FU TK ISO VLV A2 PBK	73	7600	None	Not used (momentary power)
08320300 FU TK ISO VLV B1 PBK	73	7600	None	Not used (momentary power)
08320400 FU TK ISO VLV B2 PBK	73	7600	None	Not used (momentary power)
08440 VAC-ION POWER SUPPLIES				FUNCTION:
				Power pumps that pull a vacuum between the inner and outer cryo tank shells to verify the integrity of the tank annulus.
				USAGE:
				On only during ground support activities (there are no cockpit controls).
				ANALYSIS USAGE:
08440100 O2 #4 VAC-ION PWR SUP	3	7617	None	Not used (GSE equipment)
08440200 H2 #4 VAC-ION PWR SUP	3	7617	None	Not used (GSE equipment)
08450				

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
TANK SIG COND QTY				FUNCTION: Monitor cryogenics tank quantity remaining, in percent. There is one unit per tank. USAGE: Installed on STS-3 and subsequent flights when payload requirements dictate a 4th tank set. On continuously throughout all missions when installed. ANALYSIS USAGE:
08450100 02 TNK4 SIG COND QTY	2	7617	101	STS-1 - N/A STS-2 - N/A OPS - On from pwr xfr int to EOM
08450200 H2 TNK4 SIG COND QTY	2	7617	101	STS-1 - N/A STS-2 - N/A OPS - On from pwr xfr int to EOM
08460 H202 CRYO CONTROL ASSEMBLIES				FUNCTION: Control the cryogenic heaters based on tank pressure switches. The assemblies contain circuitry for 02 heater protective devices and for heater "on" talkbacks. There is one assembly per H2/02 tank set. Assemblies 1 and 2 are interconnected in such a manner that both 02 heaters operate in unison and both H2 heaters operate in unison. The third, and

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				all additional cryo tank assemblies, will operate independently. See 06180, 06181, and 06182 for non-kitted assemblies. USAGE: Installed on STS-3 and subsequent flights when payload requirements dictate a 4th tank set. Operates continuously at the quiescent power level when installed. The cyclic power level is an incremental increase to this level, the duty cycle of which is a function of cryo heater operation. See 08650,08660 and appendix B. ANALYSIS USAGE:
08460100 H202 CRYO ASY4A-QUES	12	7617	101	STS-1 - N/A STS-2 - N/A OPS - On from pwr xfr int to EOM
08460200 H202 CRYO ASY4B-QUES	12	7617	101	STS-1 - N/A STS-2 - N/A OPS - On from pwr xfr int to EOM
08460300 H202 CRYO ASY4A-H2CY	7	7617	495	STS-1 - N/A STS-2 - N/A OPS - Cycles concurrently with cryo H2 tank 4 heater A. See 08660100 and appendix B.

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08460400 H2O2 CRYO ASY4B-H2CY	7	7617	497	STS-1 - N/A STS-2 - N/A OPS - Cycles concurrently with the cryo H2 tank 4 heater B. See 08660200 and appendix B.
08460500 H2O2 CRYO ASY4A-O2CY	25	7617	491	STS-1 - N/A STS-2 - N/A OPS - Cycles concurrently with the cryo O2 tank 4 A1 and A2 heaters. See 08650100, 08650200 and appendix B.
08460600 H2O2 CRYO ASY4B-O2CY	25	7617	493	STS-1 - N/A STS-2 - N/A OPS - Cycles concurrently with the cryo O2 tank 4 B1 and B2 heaters. See 08650300, 08650400 and and appendix B.
08510 OMS PLB HTRS (KIT)				FUNCTION: Maintain the OMS PLB kits above 40 deg F. The A and B heaters are redundant. USAGE: Installed when payload requirements dictate one or more OMS kits. Each kit increment provides an additional capability of approximately 500 fps delta velocity. When installed, the heaters are thermostatically controlled, their duty cycles being a

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				function of attitude and beta angle.
08510100 OMS PBK HTR A INCR 1	1700	7600	600 series	ANALYSIS USAGE: OFT - N/A; OPS - See appendix B heater tables
08510110 OMS PBK HTR A INCR 2	2200	7600	600 series	OFT - N/A; OPS - See appendix B heater tables
08510120 OMS PBK HTR A INCR 3	2600	7600	600 series	OFT - N/A; OPS - See appendix B heater tables
08510200 OMS PBK HTR B INCR 1	1700	7600	None	OFT - N/A; OPS - Not used (redundant equipment)
08510210 OMS PBK HTR B INCR 2	2200	7600	None	OFT - N/A; OPS - Not used (redundant equipment)
08510220 OMS PBK HTR B INCR 3	2600	7600	None	OFT - N/A; OPS - Not used (redundant equipment)
08520 OMS PBK XFER LN HTRS				FUNCTION: Maintain the lines from the Payload Bay kit to the

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Transfer Lines above 40 deg F. The A and B heaters are redundant. Once installed, post-OFT, the heaters and lines remain regardless of OMS kit requirements.
				USAGE:
				Thermostatically controlled, duty cycle is a function of attitude and beta angle.
				ANALYSIS USAGE:
08520100 PBK XFER FU LN HTR A	25	7600	Asc, 600 series	OFT - N/A
				OPS - See appendix B heater tables
08520200 PBK XFER FU LN HTR B	25	7600	None	Not used (redundant usage)
08520300 PBK XFER OX LN HTR A	25	7600	Asc, 600 series	OFT - N/A
				OPS - See appendix B heater tables
08520400 PBK XFER OX LN HTR B	25	7600	None	Not used (redundant usage)
08530 OMS PBK XFER BLKHD HTRS				FUNCTION: TBD
				USAGE:
				Thermostatically controlled, duty cycle is a function of attitude and beta angle.
				ANALYSIS USAGE:
08530100 PBK XFER FUBKD HTR A	25	7600	Asc,	OFT - N/A

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
			600 series	OPS - See appendix B heater tables
08530200 PBK XFER FUBKD HTR B	25	7600	None	Not used (redundant usage)
08530300 PBK XFER OXBKD HTR A	25	7600	Asc, 600 series	OFT - N/A OPS - See appendix B heater tables
08530400 PBK XFER OXBKD HTR B	25	7600	None	Not used (redundant usage)
08540 TV CAM HTR RH RMS				FUNCTION: Provide thermal protection for the RH Manipulator TV Camera. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). When installed, the heaters are thermostatically controlled, their duty cycles being a function of attitude and beta angle. Note: In general, the heater will be on at some duty cycle when the camera is off. It is estimated that one watt of heating will be required for each watt of operating power.
08540100 TV CAM HT-RRMS WRS	14	7600	600 series	ANALYSIS USAGE: OFT - N/A OPS - See appendix B heater tables

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
08540200 TV CAM HT-RRMS ELB	14	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08550 PAN TILT ASY HT-RRMS				FUNCTION: Provides thermal protection for the right hand RMS pan tilt assembly, if installed. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). When installed, the heaters are thermostatically controlled, their duty cycles being a function of attitude and beta angle. ANALYSIS USAGE:
08550000 PAN TLT HT-RRMS ELB	6	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08650 02 TANK 4 HEATERS				FUNCTION: Maintain pressure in cryogenic oxygen tank 4 between 840 and 875 psia. When the pressure levels in both oxygen tanks 3 and 4 fall below 840 psia, the enabled heaters are turned on. When the pressure level rises to 875 psia in either tank 3 or 4, the enabled heaters are turned off. The tank 4 heaters are cycled by H202 Cryogenic Control Assembly 4 (see 08460). Note: There is no capability to off-load cryogenics. Therefore, all installed tanks will be full

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				at the start of all missions.
				USAGE:
				Installed on STS-3 and subsequent flights when payload requirements dictate a fourth tank set. Heaters are disabled until approximately MECO + 5 min. The A heaters in all tank sets are then enabled, with tank sets 3 and 4 operating together. The A heaters in tanks 3 and 4 operate continuously until tank set 3 or 4 reaches its upper limit, at which time cyclic opration begins. Later the B heaters in each tank set are enabled to operate with the A heaters. At approximately 50% oxygen quantity remaining, the B heaters in each tank set will be disabled by the crew. This has no effect on total heater energy required. At approximately 10% oxygen remaining the A heaters are disabled. In general, the enabled heater duty cycles are a function of the average power level and oxygen quantity remaining.
				Note: Each heater cycle will correspond with a power level increase of H202 Cryogenic Control Assembly 4 (see 08460).
				ANALYSIS USAGE:
08650100 02 TANK4 HEATER A1	214	7617	491	STS-1 - N/A STS-2 - N/A OPS - See appendix B-XVI.
08650200 02 TANK4 HEATER A2	218	7617	491	STS-1 - N/A STS-2 - N/A

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - See appendix B-XVI.
08650300 02 TANK4 HEATER B1	213	7617	493	STS-1 - N/A STS-2 - N/A OPS - See appendix B-XVI.
08650400 02 TANK4 HEATER B2	219	7617	493	STS-1 - N/A STS-2 - N/A OPS - See appendix B-XVI.
08660 H2 TANK4 HEATERS				FUNCTION: Maintain pressure in cryogenic hydrogen tank 4 between 220 and 240 psia. When the pressure levels in both hydrogen tanks 3 and 4 fall below 220 psia, the enabled heaters are turned on. When the pressure level rises to 240 psia in either tank 3 or 4, the enabled heaters are turned off. The tank 4 heaters are cycled by H202 Cryogenic Control Assembly 4 (see 08460). Note: There is no capability to off-load cryogenics. Therefore, all installed tanks will be full at the start of all missions. USAGE: Installed on STS-3 and subsequent flights when payload requirements dictate a 4th tank set. Heaters are disabled until approximately MECO + 5 min. The A

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				heaters in all tank sets are then enabled, with tank sets 3 and 4 operating together. The A heaters in tanks 3 and 4 operate continuously until tank set 3 or 4 reaches its upper limit, at which time cyclic operation begins. Later the B heaters in each tank set are enabled to operate with the A heaters. At approximately 50% hydrogen quantity remaining, the B heaters in each tank set will be disabled by the crew. This has no effect on total heater energy required. At approximately 10% hydrogen remaining, the A heaters are disabled. In general, the enabled heater duty cycles are a function of the average power level and hydrogen quantity remaining. Note: Each heater cycle will correspond with a power level increase of H202 Cryogenics Control Assembly 4 (see 08460).
				ANALYSIS USAGE:
08660100 H2 TANK4 HEATER A	96	7617	495	STS-1 - N/A STS-2 - N/A OPS - See appendix B-XVI.
08660200 H2 TANK4 HEATER B	99	7617	497	STS-1 - N/A STS-2 - N/A OPS - See appendix B-XVI.
08700 RH MANIP HEATERS SYS #1				FUNCTION:

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Provide thermal protection for the RH RMS arm electronics. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). When installed, the heaters are thermostatically controlled, their duty cycles being a function of attitude and beta angle. Both are enabled when the PLB Doors are open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters. ANALYSIS USAGE:
08700100 RRMS SHDR PED HTR-1	36	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700200 RRMS SHDR YW LD HT-1	27	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700300 RRMS SHDR PH TO HT-1	19	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700400 RRMS SHDR EL TR HT-1	56	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700500				

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
RRMS ELB PH TOR HT-1	31	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700600 RRMS ELB EL TR HRT-1	56	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700700 RRMS WR FWD TR HTR-1	86	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700800 RRMS WR PH TOR HTR-1	24	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08700900 RRMS WR YW TOR HTR-1	14	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08701 RH MANIP HEATERS SYS #1				FUNCTION: Provide thermal protection for the RH RMS arm electronics. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). When installed, the heaters are thermostatically controlled, their duty cycles being a function of attitude and beta angle. Both

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				are enabled when the PLB doors are open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters. ANALYSIS USAGE:
08701100 RRMS WR ROLL EX HT-1	38	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08701200 RRMS WR ROLL EL HT-1	20	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08701300 RRMS END EFF #1 HT-1	48	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08701400 RRMS END EFF #2 HT-1	28	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08710 RH MANIP HEATERS SYS #2				FUNCTION: Provide redundant thermal protection for the RH RMS arm electronics USAGE: Installed when payload requirements dictate a RH

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				manipulator (see 08160). When installed, the heaters are thermostatically controlled, their duty cycles being a function of attitude and beta angle. Both are enabled when the PLB doors are open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters
				ANALYSIS USAGE:
08710100 RRMS SHDR PED HTR-2	36	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08710200 RRMS SHDR YW LD HT-2	27	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08710300 RRMS SHDR PH TO HT-2	19	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08710400 RRMS SHDR EL TR HT-2	56	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08710500 RRMS ELB PH TOR HT-2	31	7600	600 series	OFT - N/A OPS - See appendix B heater tables
08710600 RRMS ELB EL TR HTR-2	56	7600	600 series	OFT - N/A

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - See appendix B heater tables
08710700 RRMS WR FWD TR HTR-2	86	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables
08710800 RRMS WR PH TOR HTR-2	24	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables
08710900 RRMS WR YW TOR HRT-2	14	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables
08711 RH MANIP HEATERS SYS #2				FUNCTION: Provide redundant thermal protection for the RH RMS arm electronics. USAGE: Installed when payload requirements dictate a RH manipulator (see 08160). When installed the heaters are thermostatically controlled, their duty cycles being a function of attitude and beta angle. Both are enabled when the PLB doors are open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters.

TABLE A-VIII.- PAYLOAD MANAGEMENT AND KITTED COMPONENTS SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF.	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
08711100 RRMS WR ROLL EX HT-2	38	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables
08711200 RRMS WR ROLL EL HT-2	20	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables
08711300 RRMS END EFF #1 HT-2	48	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables
08711400 RRMS END EFF #1 HT-2	28	7600	600 series	OFT - N/A
				OPS - See appendix B heater tables

A-IX 1600
SRB

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
16010 SRB MDM'S				FUNCTION: Multiplex the SRB sensor data required by the Orbiter and demultiplex commands/interrogations directed to the SRB from the Orbiter. The MDM's transmit and receive through a pair of independent data buses, and are redundant for each LH and RH SRB. USAGE: On from pre-power transfer internal until ET/SRB separation. Note: ET/SRB separation sequence is initiated after two of three head-end chamber pressure transducers on both SRM'S tail-off to 50 psia, or less.
16010100 MDM #1 LH SRB	52	7677	203	ANALYSIS USAGE: On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16010200 MDM #2 LH SRB	52	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16010300 MDM #1 RH SRB	52	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16010400 MDM #2 RH SRB	52	7677	203	On from pwr xfr int until SRB sep

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: Exact time is L/O + 2 min 4 sec.
16030 SRB RATE GYRO ASSEMBLIES				FUNCTION: Provide angular rate information from the SRB'S. This information describes the inertial motion of the cluster to the Orbiter GNC system. USAGE: Spin mode used only in initial startup of unit at approximately T - 1.0 hr. Run mode on from approximately T - 35 min to ET/SRB separation. ANALYSIS USAGE:
16030100 RGA #1 LH SRB (RUN)	18	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16030110 RGA #1 LH SRB (SPIN)	28	7677	None	Not used (GSE usage)
16030200 RGA #2 LH SRB (RUN)	18	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16030210 RGA #2 LH SRB (SPIN)	28	7677	None	Not used (GSE usage)
16030300 RGA #3 LH SRB (RUN)	18	7677	203	On from pwr xfr int until SRB sep

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: Exact off time is L/O + 2 min 4 sec.
16030310 RGA #3 LH SRB (SPIN)	28	7677	None	Not used (GSE usage)
16030400 RGA #1 RH SRB (RUN)	18	7677	203	On from pwr xfr int until SRB sep
				Note: Exact off time is L/O + 2 min 4 sec.
16030410 RGA #1 RH SRB (SPIN)	28	7677	None	Not used (GSE usage)
16030500 RGA #2 RH SRB (RUN)	18	7677	203	On from pwr xfr int until SRB sep
				Note: Exact off time is L/O + 2 min 4 sec.
16030510 RGA #2 RH SRB (SPIN)	28	7677	None	Not used (GSE usage)
16030600 RGA #3 RH SRB (RUN)	18	7677	203	On from pwr xfr int until SRB sep
				Note: Exact off time is L/O + 2 min 4 sec.
16030610 RGA #3 RH SRB (SPIN)	28	7677	None	Not used (GSE usage)
16050 SRB SIGNAL CONDITIONERS				FUNCTION:
				Condition signals from the respective (LH or RH) SRB operational flight instrumentation sensors for input to their respective SRB MDM's (see 16010). In addition, they provide calibration signals for solid

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				rocket motor (SRM) and thrust vector control (TVC) pressure tranducers. USAGE: On from pre-power transfer internal until ET/SRB separation. ANALYSIS USAGE:
16050100 SIG COND #1 LH SRB	14	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16050200 SIG COND #2 LH SRB	14	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16050300 SIG COND #1 RH SRB	14	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16050400 SIG CON #2 RH SRB	14	7677	203	On from pwr xfr int until SRB sep Note: Exact off time is L/O + 2 min 4 sec.
16070 SRB IGNITION SAFE & ARM CONTROLS				FUNCTION: With the manual lock pins removed from the Safe & Arm devices, an electrical arming signal causes the barrier rotors to move into the armed position, thus enabling SRM ignition. There is a single device

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				on each SRM. USAGE: The ignition Safe & Arm devices are armed 5 min prior to the time-zero reference. Actuation time of the device is approximately 500 ms. Note: The SRB ignition/hold-down release signal output from the MEC is launch time t-zero, the time-zero reference which initiates the mission elapsed time (MET) registers. ANALYSIS USAGE:
16070100 IGNIT S&A DEV LH-SRB	84	7677	None	Not used (momentary power)
16070200 IGNIT S&A DEV RH-SRB	84	7677	None	Not used (momentary power)
16120 SRB CHAMBER PRESSURE TRANSDUCERS				FUNCTION: Provide a triple redundant measurement of each LH and RH SRB chamber pressure for use by the Orbiter in controlling the ET/SRB separation sequence. Note: The ET/SRB separation sequence is initiated when two of three head-end chamber pressure transducers on both SRM'S tail-off to 50 psia, or less. USAGE: On from power xfr internal until ET/SRB separation.

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
16120100 CMBR PR XDCR A LHSRB	1	7677	None	Not used (low power)
16120200 CMBR PR XDCR B LHSRB	1	7677	None	Not used (low power)
16120300 CMBR PR XDCR C LHSRB	1	7677	None	Not used (low power)
16120400 CMBR PR XDCR A RHSRB	1	7677	None	Not used (low power)
16120500 CMBR PR XDCR B RHSRB	1	7677	None	Not used (low power)
16120600 CMBR PR XDCR C RHSRB	1	7677	None	Not used (low power)
16140 SRB IGNITION ORDNANCE ARMS				FUNCTION: With the Safe & Arm devices in the armed position, the NASA Standard Initiators (NSI's) may be fired through thin barrier seals into the pyrotechnic pellet charges in the S&A devices. The pellet charges then ignite the propellant of the igniter initiator, whose combustion products, in turn, ignite the propellant of the rocket motor igniter. USAGE: The LH and RH SRB ignition, and hold-down release pyro initiator controllers (PIC's) are armed 15 sec prior to the time-zero reference. PIC capacitor voltages are verified 3 sec later. The LH and RH SRB

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ignition, and hold-down release PIC's are fired at the time-zero reference. The arm and PIC fire commands are removed when the Redundant Set Launch Sequencer determines that the MET registers are counting up. Note: The SRB ignition/hold-down release signal output from the MEC is launch time t-zero, the time-zero reference which initiates the mission elapsed time (MET) registers. ANALYSIS USAGE:
16140100 IGNIT PIC ARM A-LSRB	14	7677	201	On from 15 sec prior to lift-off until lift-off
16140200 IGNIT PIC ARM B-LSRB	14	7677	201	On from 15 sec prior to lift-off until lift-off
16140300 IGNIT PIC ARM A-RSRB	14	7677	201	On from 15 sec prior to lift-off until lift-off
16140400 IGNIT PIC ARM B-RSRB	14	7677	201	On from 15 sec prior to lift-off until lift-off
16160 SRB SEPARATION ORDNANCE ARMS				FUNCTION: Operate to separate each SRB from the ET by severing the one forward and three aft attach bolts, and igniting the forward and aft booster separation motors (BSM) USAGE: The SRB separation pyro initiator controllers (PIC's) are armed when two of three pressure transducers on both the LH and RH SRM head-end chamber tail-off

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				to 50 psia, or less. They are fired 2.0 sec later to effect ET/SRB separation.
				ANALYSIS USAGE:
16160100 SEP PIC A-FWD LH SRB	28	7677	None	Not used (momentary power)
16160200 SEP PIC B-FWD LH SRB	28	7677	None	Same as 16160100
16160300 SEP PIC A-FWD RH SRB	28	7677	None	Same as 16160100
16160400 SEP PIC B-FWD RH SRB	28	7677	None	Same as 16160100
16160500 SEP PIC A-AFT LH SRB	56	7677	None	Same as 16160100
16160600 SEP PIC B-AFT LH SRB	56	7677	None	Same as 16160100
16160700 SEP PIC A-AFT RH SRB	56	7677	None	Same as 16160100
16160800 SEP PIC B-AFT RH SRB	56	7677	None	Same as 16160100
16180 SRB APU CONTROL ASSY'S				FUNCTION:
				The APU (HPU) control assembly provides the control to the fuel shutoff and control valves. These valves allow fuel to pass to the catalyst in the gas generator. The gases formed provide the energy to drive the hydraulic pump which in turn provides hydraulic pressure to gimbal the SRM motors. Speed control sensors

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				modulate the fuel supply valves to maintain the desired pump speed. There are two control assemblies per SRM.
				USAGE:
				The HPU controller is on from pre-power transfer internal until ET/SRB separation. The hydraulic pump bypass valves are opened and the HPU's are started 20 sec prior to the time-zero reference. The bypass valves are closed 4 sec later, but the pump remains on until ET/SRB separation.
				ANALYSIS USAGE:
16180100 APU CNTL ASY A-LSRB	12	7677	203	On from pwr xfr int until ET/SRB separation
16180200 APU CNTL ASY B-LSRB	12	7677	203	Same as 16180100
16180300 APU CNTL ASY A-RSRB	12	7677	203	Same as 16180100
16180400 APU CNTL ASY B-RSRB	12	7677	203	Same as 16180100
16200 SRB HPU SENSORS				FUNCTION:
				Provides turbine shaft speed data to the HPU controllers which maintain the fuel control valves in the proper position to maintain the desired pump speed.
				USAGE:
				On for controlling purposes after HPU start-up.

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
16200100 HPU SENSOR A-LH SRB	3	7677	203	On at T-20 seconds until ET/SRB SEP
16200200 HPU SENSOR B-LH SRB	3	7677	203	Same as 16200100
16200300 HPU SENSOR A-RH SRB	3	7677	203	Same as 16200100
16200400 HPU SENSOR B-RH SRB	3	7677	203	Same as 16200100
16210 SRB HYD PUMP BYPASS VALVES				FUNCTION: Bypasses hydraulic fluid around pump during HPU start. USAGE: Valve is actuated open for 4 seconds while HPU turbine is brought to operating speed at approximately T - 20 sec.
				ANALYSIS USAGE:
16210100 HYD PMP BYP V A-LSRB	35	7677	None	Not used (momentary power)
16210200 HYD PMP BYP V B-LSRB	35	7677	None	Same as 16210100
16210300 HYD PMP BYP V A-RSRB	35	7677	None	Same as 16210100

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
16210400 HYD PMP BYP V B-RSRB	35	7677	None	Same as 16210100
16220 SRB FSM ISOLATION VALVES				FUNCTION: Isolates the hydrazine in the fuel supply module from the fuel pump. USAGE: The isolation valves are opened in the start sequence to allow fuel to flow through the fuel pump to the fuel control valves. ANALYSIS USAGE:
16220100 FSM ISOL VLV A-LSRB	26	7677	203	On from T-20 sec until ET/SRB separation.
16220200 FSM ISOL VLV B-LSRB	26	7677	203	Same as 16220100
16220300 FSM ISOL VLV A-RSRB	26	7677	203	Same as 16220100
16220400 FSM ISOL VLV B-RSRB	26	7677	203	Same as 16220100
16230 SRB FUEL SHUTOFF VALVES				FUNCTION: The fuel shutoff valve is a normally closed valve. When open, hydrazine flows to the catalyst bed in the gas generator provided that the fuel control valve is

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				open. It also functions as a control valve should the controller sense speeds in excess of approx 80,500 rpm (112%). When closed, the fuel is bypassed to the fuel pump. USAGE: The valve is opened at HPU start and remains open unless commanded closed by the HPU controller. ANALYSIS USAGE:
16230100 FUEL S/OFF A-LSRB	42	7677	203	On at T-20 sec until ET/SRB sep.
16230200 FUEL S/OFF B-LSRB	42	7677	203	Same as 16230100
16230300 FUEL S/OFF A-RSRB	42	7677	203	Same as 16230100
16230400 FUEL S/OFF B-RSRB	42	7677	203	Same as 16230100
16240 SRB FUEL CONTROL VALVES				FUNCTION: The fuel control valve is a normally open valve which is operated in a cyclic mode in response to commands from the HPU controller. When open, fuel flows to the catalyst bed in the gas generator. When closed the fuel is bypassed back to the fuel pump. It operates in conjunction with the fuel shutoff valve. USAGE: When the HPU speed sensors sense rpm greater than

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				approximately 79,000 rpm the controller powers the valve closed until the speed drops below 72,000 rpm.
				ANALYSIS USAGE:
16240100 FUEL CNTL VL A-LSRB	42	7677	203	Closed at T-16 sec and then cycled at 65% duty cycle until SRB Sep.
16240200 FUEL CNTL VL B-LSRB	42	7677	203	Same as 16240100
16240300 FUEL CNTL VL A-RSRB	42	7677	203	Same as 16240100
16240400 FUEL CNTL VL B-RSRB	42	7677	203	Same as 16240100
16241 SRB HPU GG HTR INSTR.				FUNCTION:
				Provide instrumentation and switching control for the GG heaters (Ref. 16250000).
				USAGE:
				On concurrently with components 16250000.
				ANALYSIS USAGE:
16241100 HPU GG HTR A IN LSRB	2	7677	Asc	See Appendix B heater tables
16241200 HPU GG HTR B IN LSRB	2	7677	Asc	See Appendix B heater tables
16241300 HPU GG HTR A IN RSRB	2	7677	Asc	See Appendix B heater tables

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
16241400 HPU GG HTR B IN RSRB	2	7677	Asc	See Appendix B heater tables
16250 SRB GAS GENERATOR HEATERS				FUNCTION: Provide thermal environment to the catalyst bed of the gas generator prior to HPU start. USAGE: The heaters are turned on at T-2 hours to allow the bed temperature to rise to between 190° and 248° F prior to HPU start at T-20 seconds. After HPU start no further heater use is required. Redundant heaters are provided for each HPU. ANALYSIS USAGE:
16250100 HPU A GG HTR 1-LHSRB	60	7677	Asc	See Appendix B heater tables
16250210 HPU A GG HTR 2-LHSRB	60	7677	None	Not used (redundant equipment)
16250300 HPU B GG HTR 1-LHSRB	60	7677	Asc	See Appendix B heater tables
16250410 HPU B GG HTR 2-LHSRB	60	7677	None	Not used (redundant equipment)
16250500 HPU A GG HTR 1-RHSRB	60	7677	Asc	See Appendix B heater tables
16250610 HPU A GG HTR 2-RHSRB	60	7677	None	Not used (redundant equipment)

TABLE A-IX.- SOLID ROCKET BOOSTER SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
16250700 HPU B GG HTR 1-RHSRB	60	7677	Asc	See Appendix B heater tables
16250810 HPU B GG HTR 2-RHSRB	60	7677	None	Not used (redundant equipment)

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20010 MAIN ENGINE CONTROLLERS				FUNCTION: Control sequencing and thrust level of the SSME's in response to GPC commands. They also collect and process all engine data for transfer to the Orbiter and monitor critical parameters for out-of-tolerance conditions. Channel B is a redundant dynamic standby controller. USAGE: Normal - All channels on from pwr xfr int through completion of propellant dump. The power level of each control channel varies from 310 W to approx 490 W with an average of approx 400 W for Channel A in control and 413 W for Channel B in control. The power level of standby channels averages approx 285 W. RTLS - All channels on from pwr xfr int to stoproll. ANALYSIS USAGE:
20010100 MN ENG CNTLR 1-CH A	480	7677	203,209	The usage factors for channel A for all missions are:

From	To	Usage Factor
Pwr xfr int	L/Off - 5 min	75.0%
L/Off - 5 min	L/Off - 4 sec	100.0%
L/Off - 4 sec	L/Off	96.9%
L/Off	Meco + 4 sec	87.5%
Meco + 4 sec	Meco + 7 min	72.9%

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20010200 MN ENG CNTLR 1-CH B	330	7677	203,209	The usage factors for channel B for all missions are: From / To / Usage Factor Pwr xfr int / L/Off - 4 sec / 86.4% L/Off - 4 sec / L/Off / 100.0% L/Off / Meco + 7 min / 86.4%
20010300 MN ENG CNTLR 2-CH A	480	7677	203,209	same as 20010100
20010400 MN ENG CNTLR 2-CH B	330	7677	203,209	same as 20010200
20010500 MN ENG CNTLR 3-CH A	480	7677	203,209	same as 20010100
20010600 MN ENG CNTLR 3-CH B	330	7677	203,209	same as 20010200
20030 LOX PREVALVE SOLENOIDS				FUNCTION: Provide pneumatics to actuate the bi-stable LO2 Prevalves. The LO2 Prevalves back up the Main Engine Valves for terminating LO2 flow at engine shutdown. There is one open and one close solenoid for each prevalve. The solenoids need only be energized during prevalve movement but the open solenoids will be powered during engine operation for redundancy. USAGE: Normal - Open solenoids energized from pwr xfr int to MECO + 4 sec and for duration of the LO2 dump (1 min 55 sec). Close solenoids energized from

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				MECO + 4 sec to MECO + 8 sec and from MECO + 3 min 56 sec to MECO + 3 min 58. RTLS - Open solenoids energized from pwr xfr to MECO + 4 sec and for duration of the RTLS dump. Close solenoids energized from MECO + 4 sec to MECO + 8 sec and for 2 sec at the end of the RTLS dump.
				ANALYSIS USAGE:
20030100 LOX PREVLV 1 OP SOL	39	7677	203,209	On from pwr xfr int to MECO + 4 sec; on from MECO + 2 min 1 sec until MECO + 3 min 56 sec
20030210 LOX PREVLV 1 CL SOL	39	7677	209	On from MECO + 4 sec to MECO + 8 sec and from MECO + 3 min 56 sec to MECO + 3 min 58 sec
20030300 LOX PREVLV 2 OP SOL	39	7677	203,209	On from pwr xfr int to MECO + 4 sec; on from MECO + 2 min 1 sec to MECO + 3 min 56 sec
20030410 LOX PREVLV 2 CL SOL	39	7677	209	On from MECO + 4 sec to MECO + 8 sec and from MECO + 3 min 56 sec to MECO + 3 min 58 sec
20030500 LOX PREVLV 3 OP SOL	39	7677	203,209	On from pwr xfr int to MECO + 4 sec; on from MECO + 2 min 1 sec to MECO + 3 min 56 sec
20030610 LOX PREVLV 3 CL SOL	39	7677	209	On from MECO + 4 sec to MECO + 8 sec and from MECO + 3 min 56 sec to MECO + 3 min 58 sec

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20040 LH2 PREVALVE SOLENOIDS				FUNCTION: Provide pneumatics to actuate the bi-stable LH2 Prevalves. The LH2 Prevalves when closed: 1), force LH2 Recirc Pump flow through the engines during prelaunch chilldown; and 2), backup the Main Engine Valves for terminating LH2 flow at engine shutdown. There is one open and one close solenoid for each prevalve. The solenoids need only be energized during prevalve movement, but the open solenoids will be powered during engine operation for redundancy. USAGE: Normal - Close solenoids energized at T - 15 min for LH2 Recirc; de-energized at T - 8 sec; energized from MECO + 6 sec to MECO + 8 sec. Open solenoids energized from T - 8 sec to MECO + 6 sec, and for the duration of the LH2 dump (56 sec). RTLS - Close solenoids energized at T - 15 min for LH2 Recirc; de-energized at T - 8 sec; energized from MECO + 6 sec to MECO + 8 sec. Open solenoids energized from T - 8 sec to MECO + 6 sec and for the duration of the RTLS dump. ANALYSIS USAGE:
20040100 LH2 PREVLV 1 OP SOL	39	7677	203,209	On from T - 8 sec to MECO + 6 sec; on from MECO + 3 min 57 sec to MECO + 4 min 53 sec
20040210 LH2 PREVLV 1 CL SOL	39	7677	201,209	On from pwr xfr int to T - 8 sec and from MECO + 6 sec to MECO + 8 sec
20040300				

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
LH2 PREVLV 2 OP SOL	39	7677	203,209	Same as 20040100
20040410 LH2 PREVLV 2 CL SOL	39	7677	201,209	Same as 20040210
20040500 LH2 PREVLV 3 OP SOL	39	7677	203,209	Same as 20040100
20040610 LH2 PREVLV 3 CL SOL	39	7677	201,209	Same as 20040210
20050 LO2 FILL & DRAIN VALVE O/B SOLENOIDS				FUNCTION: Provide pneumatics to actuate the bi-stable LO2 Outboard Fill and Drain Valve. The Fill and Drain Valves seal the Umbilical Fill and Drain Ducts for flight, and open the Feed Ducts post-dump for vacuum inerting. The solenoids need only be energized during valve movement; however, the solenoids will be continually powered during critical periods to ensure maintenance of correct valve position. USAGE: Normal - Open solenoid energized from start of propellant loading to completion of fill line drain at approx T - 18 sec. Close solenoid energized from then until MECO + 4 min 53 sec. Open solenoid energized for 22 min for inerting. Then close solenoid energized for 10 sec. RTLS - Open solenoid same as normal with the exception of no post T - 18 sec ops. Close solenoid energized

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				from T - 18 sec to a ground relative velocity of < 4500 fps + 2 sec.
				ANALYSIS USAGE:
20050100 LO2 OB F&D VL CL SOL	39	7677	203,209	On from T - 18 sec to MECO + 4 min 53 sec; on from MECO + 30 min to MECO + 30 min 10 sec
20050210 LO2 OB F&D VL OP SOL	39	7677	201,209	On from pwr xfr int to T - 18 sec; on from MECO + 8 min to MECO + 30 min
20060 LO2 FILL & DRAIN VALVE I/B SOLENOIDS				FUNCTION: Provide pneumatics to actuate the bi-stable LO2 Inboard Fill and Drain Valve. The Fill and Drain Valves seal the Umbilical Fill and Drain ducts for flight, and open the Feed Ducts post-dump for vacuum inerting. The solenoids need only be energized during valve movement. However, the solenoids will be continually powered during critical periods to ensure maintenance of correct valve position. USAGE: Normal - Open solenoid energized from start of propellant loading to completion of LO2 replenish at approx T - 9 min. Close solenoid energized from then until MECO + 4 min 53 sec. Open solenoid energized for 22 min for inerting.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				RTLS - Open solenoid same as normal with the exception of no post T - 9 min ops. Close solenoid energized from T - 9 min to a ground relative velocity of < 4500 fps + 2 sec.
				ANALYSIS USAGE:
20060100 LO2 IB F&D VL CL SOL	39	7677	203,209	On from T - 9 min to MECO + 4 min 53 sec
20060210 LO2 IB F&D VL OP SOL	39	7677	201,209	On from pwr xfr int to T - 9 min; on from MECO + 8 min to MECO + 30 min
20070 LH2 FILL & DRAIN VALVE O/B SOLENOIDS				FUNCTION:
				Provide pneumatics to actuate the bi-stable LH2 Outboard Fill and Drain Valve. The Fill and Drain Valves seal the Umbilical Fill and Drain Ducts for flight, and open the LH2 Feed Duct post-dump for vacuum inerting. The solenoids need only be energized during valve movement. However, the solenoids will be continually powered during critical periods to ensure maintenance of correct valve position.
				USAGE:
				Normal - Open solenoid energized from start of propellant loading until completion of fill line drain at approx T - 18 sec. Close solenoid energized from then to MECO + 4 min 53 sec. Open solenoid energized for 22 min at start of inerting. Then close solenoid energized for 10 sec.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				RTLS - Open solenoid same as normal with exception of no post T - 18 sec. Close solenoid energized from T - 18 sec to a ground relative velocity of < 4500 fps + 2 sec.
				ANALYSIS USAGE:
20070100 LH2 OB F&D VL CL SOL	39	7677	203,209	On from T - 18 sec to MECO + 4 min 53 sec; on from MECO + 30 min to MECO + 30 min 10 sec
20070210 LH2 OB F&D VL OP SOL	39	7677	201,209	On from pwr xfr int to T - 18 sec; on from MECO + 8 min to MECO + 30 min
20080 LH2 FILL & DRAIN VALVE I/B SOLENOIDS				FUNCTION:
				Provide pneumatics to actuate the bi-stable LH2 Inboard Fill and Drain Valve. The Fill and Drain Valves seal the umbilical Fill and Drain Ducts for flight, and open the LH2 Feed Duct post-dump for vacuum inerting. The solenoids need only be energized during valve movement. However, the solenoids will be continually powered during critical periods to ensure maintenance of correct valve position.
				USAGE:
				Normal - Close solenoid energized from start of LH2 replenish at approx T - 1 hr to MECO + 4 min 53 sec. Open solenoid energized 22 min for inerting and from 1 hr 55 min prior to entry interface until stoproll.
				RTLS - Open solenoid not used. Closed solenoid energized from T - 1 hr to a ground relative velocity of < 4500 fps + 2 sec.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: Energizing the open solenoid for the manual sequences (inerting and manifold repress) results in energizing the LH2 Hi Pt Bleed valve and the LH2 topping valve, which are wired to the same switch (see 20081 and 20090). The manifold repress is specifically for that purpose.
				ANALYSIS USAGE:
20080100 LH2 IB F&D VL CL SOL	39	7677	203,209	On from pwr xfr int to MECO + 4 min 53 sec
20080210 LH2 IB F&D VL OP SOL	39	7677	209,503	On from MECO + 8 min to MECO + 30 min; on from 1 hr 55 min prior to entry interface until stoproll
20081 LH2 HI PT BLD VALVE				FUNCTION: Permits removal of vapor bubbles from the high point of the 17 in. Orbiter/ET feedline during prestart conditioning. It is a normally closed solenoid valve. USAGE: Normal - This valve is opened intermittently from LH2 fast fill completion until LH2 tank prepress complete (T - 1 min 20 sec) when it is closed. It is opened again for vacuum inerting and for manifold repressurization. In the event of an RTLS this valve will not be utilized.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: This valve is energized in the manual sequences (inerting and manifold repress) via the LH_2 F & D Inboard solenoid open switch (see 20080).
				ANALYSIS USAGE:
20081000 LH2 HI PT BLD VALVE	39	7677	201,209,503	On from pwr xfr int to T - 1 min 20 sec; on from MECO + 8 min to MECO + 30 min; on from 1 hr 55 min prior to entry interface until stoproll
20090 LH2 TOPPING VALVE OPEN SOLENOID				FUNCTION: Provides pneumatics to open the normally closed LH2 Replenishing Valve for LH2 replenish. USAGE: Normal - Energized when the LH2 Inboard Fill and Drain Valve is closed to initiate LH2 replenish at approx T - 1 hr. De-energized at completion of LH2 replenish at approx T - 1 min 52 sec. Energized from MECO + 8 min to MECO + 30 min for vacuum inerting. On from 1 hr 55 min prior to entry interface until stoproll. RTLS - Same as normal with the exception of no post T - 1 min 52 sec operations. Note: This valve is energized in the manual sequences (inerting and manifold repress) via the LH_2 F & D Inboard solenoid open switch (see 20080).

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
20090000 LH2 TOP VLV OP SOL	39	7677	201,209,503	On from pwr xfr int to T - 1 min 52 sec; on from MECO + 8 min to MECO + 30 min; on from 1 hr 55 min prior to entry interface until stoproll
20100 LH2 RECIRC PUMP VALVE OPEN SOLENOID				FUNCTION: Provides pneumatics to open the three normally closed LH2 Recirc Valves. Each LH2 Recirc Valve provides a path from an LH2 Recirc Pump to the corresponding engine for engine chilldown. USAGE: Normal - Energized from start of LH2 chilldown at approx T - 45 min to completion at approx T - 8 sec. This component uses only GSE power.
				ANALYSIS USAGE:
20100000 LH2 REC PMP VL OP SL	39	7677	None	Not used - GSE power
20110 LO2 FEED DISCONNECT VALVE SOLENOIDS				FUNCTION: Provide pneumatics to actuate the bi-stable LO2 Feed Disconnect Valve. The LO2 Feed Disconnect Valve seals the ET/Orbiter LO2 Feed Duct at ET separation. The solenoids need only be energized during valve movement, but will be continually powered during critical periods to ensure maintenance of correct valve position.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Normal - Open solenoid energized from the start of propellant loading to MECO + 7 sec. Close solenoid energized from MECO + 7 sec to MECO + 4 min 53 sec.
				RTLS - Open solenoid same as normal. Close solenoid energized from MECO + 7 sec to a ground relative velocity of < 4500 fps + 2 sec.
				ANALYSIS USAGE:
20110100 LO2 FD DSC VL OP SOL	39	7677	203,209	On from pwr xfr int to MECO + 7 sec
20110210 LO2 FD DSC VL CL SOL	39	7677	209	On from MECO + 7 sec to MECO + 4 min 53 sec
20120 LH2 FEED DISCONNECT VALVE SOLENOIDS				FUNCTION:
				Provide pneumatics to actuate the bi-stable LH2 Feed Disconnect Valve. The LH2 Feed Disconnect Valve seals the ET/Orbiter LH2 Feed Duct at ET separation. The solenoids need only to be energized during valve movement, but will be continually powered during critical periods to ensure maintenance of correct valve position.
				USAGE:
				Normal - Open solenoid energized from the start of propellant loading to MECO + 7 sec. Close solenoid energized from MECO + 7 sec to MECO + 4 min 53 sec.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				RTLS - Open solenoid same as normal. Close solenoid energized from MECO + 7 sec to a ground relative velocity of <4500 fps + 2 sec.
				ANALYSIS USAGE:
20120100 LH2 FD DSC VL OP SOL	39	7677	203,209	On from pwr xfr int to MECO + 7 sec
20120210 LH2 FD DSC VL CL SOL	39	7677	209	On from MECO + 7 sec to MECO + 4 min 53 sec
20130 LH2 RECIRC DISCONNECT VALVE SOLENOIDS				FUNCTION:
				Provide pneumatics to actuate the bi-stable LH2 Recirc Disconnect Valve. The Recirc Disconnect Valve seals the ET/Orbiter LH2 Recirc Line at ET separation. The solenoids need only be energized during valve movement, but will be continually powered during critical periods to ensure maintenance of correct valve position.
				USAGE:
				Normal - Open solenoid energized from the start of propellant loading to MECO + 6 sec. Close solenoid energized from MECO + 6 sec to MECO + 4 min 53 sec.
				RTLS - Open solenoid same as normal. Close solenoid energized from MECO + 6 sec to a ground relative velocity of <4500 fps + 2 sec.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
20130100 LH2 RC DSC VL OP SOL	39	7677	203,209	On from pwr xfr int to MECO + 6 sec
20130210 LH2 RC DSC VL CL SOL	39	7677	209	On from MECO + 6 sec to MECO + 4 min 53 sec
20140 LO2 FEEDLINE RLF S/V SOLENOID				FUNCTION: Provides pneumatics to close the normally open LO2 Feedline Relief Shutoff Valve. The Feedline Relief Shutoff Valve isolates the LO2 manifold from the manifold relief valve during boost, then opens the manifold to the relief valve at engine shutdown. USAGE: For normal usage and in the event of an RTLS they are energized from the start of propellant loading to MECO.
				ANALYSIS USAGE:
20140000 LO2 REL'F S/V CL SOL	39	7677	203	On from pwr xfr int to MECO
20150 LH2 FEEDLINE RLF S/V SOLENOID				FUNCTION: Provides pneumatics to close the normally open LH2 Feedline Relief Shutoff Valve. The Feedline Relief Shutoff Valve isolates the LH2 manifold from the manifold relief valve during boost, then opens the manifold to the relief valve at engine shutdown.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				For normal usage and in the event of an RTLS they are energized from the start of propellant loading to MECO.
				ANALYSIS USAGE:
20150000 LH2 REL'F S/V CL SOL	39	7677	203	On from pwr xfr int to MECO
20160 GH2 PRESSURIZATION LINE VENT VALVE				FUNCTION:
				Provides for venting the LH2 pressurization line during vacuum inerting. This normally closed solenoid valve bypasses the LH2 Pressurization Disconnect which closes at ET separation.
				USAGE:
				For normal usage they are energized for 5 min at start of vacuum inerting. Not used in the event of an RTLS.
				ANALYSIS USAGE:
20160000 GH2 PRS'N LNE VNT VL	39	7677	209	On from MECO + 8 min to MECO + 9 min

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20180 LO2 MANIFOLD REPRESSURIZATION VALVES				FUNCTION: Supply helium to purge the LO2 manifold during LO2 dump and to pressurize the LO2 manifold and pressurization lines prior to entry. There are two normally closed solenoid valves in series. USAGE: Both energized during LO2 dump for 140 sec, both energized from approx 2 hrs prior to entry until touchdown. They are not used for RTLS. ANALYSIS USAGE:
20180100 LO2 MANF REPRS VL 1	39	7677	209,503	On from MECO + 2 min 1 sec to MECO + 3 min 46 sec; on from 1 hr 55 min prior to entry interface until stoproll
20180200 LO2 MANF REPRS VL 2	39	7677	209,503	On from MECO + 2 min 1 sec to MECO + 3 min 46 sec; on from 1 hr 55 min prior to entry interface until stoproll
20190 LH2 MANIFOLD REPRESSURIZATION VALVES				FUNCTION: Supply helium to purge the LH2 manifold during LH2 dump and to pressurize the LH2 manifold, pressurization, and recirc lines prior to entry. There are two normally closed solenoid valves in series.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Both energized during LH2 dump for 37 sec, both energized from 1 hr 55 min prior to entry interface until stoproll. They are not used in the event of an RTLS.
				ANALYSIS USAGE:
20190100 LH2 MANF REPRS VL 1	39	7677	209,503	On from MECO + 4 min 6 sec to MECO + 4 min 43 sec; on from 1 hr 55 min prior to entry interface until stoproll
20190200 LH2 MANF REPRS VL 2	39	7677	209,503	On from MECO + 4 min 6 sec to MECO + 4 min 43 sec; on from 1 hr 55 min prior to entry interface until stoproll
20200 ENGINE HELIUM INTERCONNECT VALVES				FUNCTION:
				Interconnect the pneumatic helium supply to the engine helium system or vice versa.
				USAGE:
				Normal (In-valves) - Engine #2 valve open from 1 hr 55 min prior entry interface to stoproll.
				RTLS (In-valves) - All open at MECO to MECO + 20 sec.
				Normal (Out-valves) - All open from MECO + 20 sec to completion of the propellant dump (4 min 53 sec) and engine #1 and #3 open 1 hr 55 min prior to entry interface until stoproll.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				RTLS (Out-valves) - All open from MECO + 22 sec to ground relative velocity <4500 fps + 2 sec.
				ANALYSIS USAGE:
20200100 ENG 1 HE INT IN VL	39	7677	None	Not used
20200210 ENG 1 HE INT OUT VL	39	7677	209,503	On from MECO + 20 sec to MECO + 4 min 53 sec; on from 1 hr 55 min prior to entry interface until stoproll.
20200300 ENG 2 HE INT IN VL	39	7677	503	On from 1 hr 55 min prior to entry interface until stoproll.
20200410 ENG 2 HE INT OUT VL	39	7677	209	On from MECO + 20 sec to MECO + 4 min 53 sec
20200500 ENG 3 HE INT IN VL	39	7677	None	Not used
20200610 ENG 3 HE INT OUT VL	39	7677	209,503	On from MECO + 20 sec to MECO + 4 min 53 sec and from 1 hr 55 min prior to entry interface until stoproll
20210 ENGINE HELIUM SUPPLY ISOLATION VALVES				FUNCTION:
				Isolate the Engine Helium Supply bottles from the engine systems. There are two, parallel, normally closed solenoid valves in each Engine Helium System.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Normal - All energized from the start of propellant loading to MECO + 8 min, only engine #2 open for 22 min for vacuum inerting, and from 1 hr 55 min prior to entry interface until stoproll.
				RTLS - All energized from start of propellant loading to stoproll.
				ANALYSIS USAGE:
20210100 ENG 1 HE SPY ISO VLA	39	7677	203,209	On from pwr xfr int to MECO + 8 min
20210200 ENG 1 HE SPY ISO VLB	39	7677	203,209	Same as 20210100
20210300 ENG 2 HE SPY ISO VLA	39	7677	203,209,503	On from pwr xfr int to MECO + 30 min; on from 1 hr 55 min prior to entry interface until stoproll
20210400 ENG 2 HE SPY ISO VLB	39	7677	203,209,503	Same as 20210300
20210500 ENG 3 HE SPY ISO VLA	39	7677	203,209	Same as 20210100
20210600 ENG 3 HE SPY ISO VLB	39	7677	203,209	Same as 20210100

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20220 PNEUMATIC HELIUM SUPPLY ISOLATION SOLENOIDS				FUNCTION: Isolate the Vehicle Pneumatic Valve Helium Supply Bottle from the pneumatic systems. There are two, parallel, normally closed solenoid valves. USAGE: Normal - Both energized from the start of propellant loading to MECO + 30 min and from entry interface + 10 min until stoproll. RTLS - Both energized from start of propellant loading to stoproll. ANALYSIS USAGE:
20220100 PNEU HE SPY ISO VL 1	39	7677	203,209,503	On from pwr xfr int to MECO + 30 min and from entry interface + 10 min until stoproll
20220200 PNEU HE SPY ISO VL 2	39	7677	203,209,503	Same as 20220100
20230 HELIUM SUPPLY BLOWDOWN VALVES				FUNCTION: Provide a means of venting the Helium Bottles for ground servicing. There are two normally closed solenoid valves in series.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				On only during ground support activities.
				ANALYSIS USAGE:
20230100 HE SPY BLOWDN VLV #1	39	7677	None	Not used - GSE power
20230200 HE SPY BLOWDN VLV #2	39	7677	None	Not used - GSE power
20240 GO2 FLOW CONTROL VALVES				FUNCTION:
				Control LO2 tank pressurization flow from the engine during engine operation to maintain a tank pressure of 20-22 psia. There are three normally open solenoid valves in parallel. Valve operation is controlled by ullage pressure transducers located on the ET.
				USAGE:
				Closed between LO2 tank pre-press at approx T - 2 min 53 sec until lift-off, then cycled until MECO. Closed times average approximately 23 sec/cycle for 10 cycles. RTLS usage is TBD.
				ANALYSIS USAGE:
20240100 GO2 FLOW CNTL VLV #1	54	7677	201,203	On with 100% usage factor between 2 min 53 sec prior to lift-off and lift-off, then on at 43.7% usage factor from lift-off until MECO.
20240200 GO2 FLOW CNTL VLV #2	54	7677	201,203	Same as 20240100

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20240300 GO2 FLOW CNTL VLV #3	54	7677	201,203	Same as 20240100
20250 GH2 FLOW CONTROL VALVES				FUNCTION: Control LH2 tank pressurization flow from the engine during engine operation to maintain a tank pressure of 32-34 psia. There are three normally open solenoid valves in parallel. Valve operation is controlled by ullage pressure transducers located on the ET. USAGE: Closed between LH2 tank pre-press at approx T - 1 min 50 sec until lift-off, then cycled until MECO. Closed times average approximately 13 sec/cycle for 13 cycles. RTLS usage is TBD. ANALYSIS USAGE:
20250100 GH2 FLOW CNTL VLV #1	63	7677	201,203	On with 100% usage factor between 1 min 50 sec prior to lift-off and lift-off, then on at 32.7% usage factor from lift-off until MECO.
20250200 GH2 FLOW CNTL VLV #2	63	7677	201,203	Same as 20250100
20250300 GH2 FLOW CNTL VLV #3	63	7677	201,203	Same as 20250100

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20270 ULLAGE PRESSURE SIGNAL CONDITIONERS				FUNCTION: Provide power and signal conditioning to the ullage pressure transducers which control the pressurization flow control valves. USAGE: For normal usage and in the event of an RTLS they are all on from pwr xfr int until power is deadfaced prior to ET jettison. ANALYSIS USAGE:
20270100 ULL PRES SIG COND #1	12	7677	203,209	On from pwr xfr int to MECO + 9 sec
20270200 ULL PRES SIG COND #2	12	7677	203,209	On from pwr xfr int to MECO + 9 sec
20270300 ULL PRES SIG COND #3	12	7677	203,209	On from pwr xfr int to MECO + 9 sec
20280 POINT SENSOR ELECTRONICS				FUNCTION: Provide power and logic for propellant tank level sensors. The level sensors are utilized for propellant loading, to command engines shutdown in the event of impending propellant depletion, and to indicate discrete low levels during ascent (2 and 5% levels).

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				For normal usage and in the event of an RTLS they are on from pwr xfr int until power is deadfaced prior to ET jettison.
				ANALYSIS USAGE:
20280100 POINT SNSR ELEC-BUS1	30	7677	203,209	On from pwr xfr int to MECO + 9 sec
20280200 POINT SNSR ELEC-BUS2	30	7677	203,209	Same as 20280100
20280300 POINT SNSR ELEC-BUS3	30	7677	203,209	Same as 20280100
20280400 POINT SNSR ELEC-BUS4	30	7677	203,209	Same as 20280100
DIFFERENTIAL PRESS SIGNAL CONDITIONER				FUNCTION:
				Provides an indication of the pressure differential between the top and bottom of each propellant tank.
				USAGE:
				Used during propellant loading. On from start of propellant loading to engine start. This component uses only GSE power.
				ANALYSIS USAGE:
20310000 DIFF PRES SIG COND	25	7677	None	Not used - (GSE power)

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20320 LO2 POGO ACCUM VALVES				FUNCTION: Provide pneumatics to close the two, parallel, normally open LO2 Pogo Accumulator Recirc Valves. The Recirc Valves when closed force LO2 Bleed flow return to the umbilical. When open they permit LO2 Bleed flow return from the Pogo Accumulator to the LO2 Feed Line. USAGE: Both energized from the start of propellant loading until approx T - 12 sec. ANALYSIS USAGE:
20320100 LO2 POGO ACC VL 1 CL	39	7677	201	On from pwr xfr int to T - 12 sec
20320200 LO2 POGO ACC VL 2 CL	39	7677	201	On from pwr xfr int to T - 12 sec
20330 LO2 OVERBOARD BLEED VALVE SOLENOID				FUNCTION: Provides pneumatics to close the normally open LO2 Overboard Bleed Valve. The Overboard Bleed Valve when closed provides a redundant seal to the LO2 Bleed Umbilical Quick Disconnect. When open it provides a return path to the umbilical for engine LO2 Prelaunch Chilldown Bleed flow.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Normal - Energized from approx T - 7 sec to MECO + 4 min 53 sec.
				RTLS - Energized at approximately T - 7 sec to a ground relative velocity of < 4500 fps + 2 sec.
				ANALYSIS USAGE:
20330000 LO2 OVBD BL VL CL SL	39	7677	203,209	On from T - 7 sec to MECO + 4 min 53 sec
20340 LH2 RTLS DUMP VALVES				FUNCTION:
				Provide pneumatics to open the normally closed LH2 Feed RTLS Dump Valves. The Inboard and Outboard LH2 Feed RTLS Dump Valves are two series connected valves which permit the LH2 Feed System to be dumped in the event of an RTLS abort.
				USAGE:
				Normal - not used.
				RTLS - Energized from MECO + 22 sec to a ground relative velocity of < 4500 fps. For STS-1 and 2, this ground relative velocity is expected to occur at approx 23 min 35 sec after entry interface.
				ANALYSIS USAGE:
20340100 LH2 RTLS IB DMP V OP	39	7677	None	Not used - contingency equipment
20340200 LH2 RTLS OB DMP V OP	39	7677	None	Not used - contingency equipment

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20350 LH2 RTLS REPRESSURI-ZATION VALVES				FUNCTION: Provide Helium to pressurize the LH2 Feed System for dump in the event of an RTLS abort. There are two normally closed solenoid valves in series. USAGE: Normal - not used. RTLS - Energized from MECO + 22 sec to a ground relative velocity 4500 fps. ANALYSIS USAGE:
20350100 LH2 RTLS REPRS VL #1	39	7677	None	Not used - contingency equipment
20350200 LH2 RTLS REPRS VL #2	39	7677	None	Not used - contingency equipment
20360 ENG 2 PNEU XOVER VLV	39			FUNCTION: Provide an interconnect from the Engine #2 Helium System to the Vehicle Pneumatic Valve Helium System. It also provides a backup helium source to Engine #2 in case of an engine helium leak during ascent. There is one normally closed solenoid valve. USAGE: Normal - Energized at MECO + 20 sec to completion of the propellant dump. Energized from entry interface until stoproll.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				RTLS - Energized from MECO + 22 sec to a ground relative velocity of 4500 fps + 2 sec.
				ANALYSIS USAGE:
20360000 ENG 2 PNEU XOVER VLV	39	7677	209,503	On from MECO + 20 sec to MECO + 4 min 53 sec; on from entry interface until stoproll
20370 ENGINE FASCOS SYSTEM				FUNCTION:
				Provides for an automatic shutdown of an SSME if vibration redlines are exceeded. One unit per engine is mounted on the main engine controller. Six accelerometers are used to supply radial acceleration data to the units. Four are mounted 90° apart on the oxidizer turbo-pump housing. Violation of acceleration limits from these accelerometers will result in an engine shutdown. The remaining two accelerometers are mounted to the fuel turbo-pump housing and are for information only.
				USAGE:
				All units are powered from pwr xfr int through stoproll. However, the signals are inhibited from causing a shutdown until TBD sec after SSME ignition and during SSME throttling.
				ANALYSIS USAGE:
20370100 ENG 1 FASCOS SYS A	23	0077	103,105,111	OFT - On from pwr xfr int through stoproll
				OPS - N/A

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20370200 ENG 1 FASCOS SYS B	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20370300 ENG 1 FASCOS SYS C	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20370400 ENG 2 FASCOS SYS A	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20370500 ENG 2 FASCOS SYS B	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20370600 ENG 2 FASCOS SYS C	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20370700 ENG 3 FASCOS SYS A	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20370800 ENG 3 FASCOS SYS B	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A

TABLE A-X.- MAIN PROPULSION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
20370900 ENG 3 FASCOS SYS C	23	0077	103,105,111	OFT - same as 20370100 OPS - N/A
20510 MAIN ENGINE HEATERS				FUNCTION: Maintain the Main Engine Controllers above -65° F. USAGE: Each enabled by the crew when its corresponding Main Engine Controller is off. Thermostatically controlled, duty cycle is a function of attitude and beta angle. ANALYSIS USAGE:
20510100 MAIN ENG HTR #1	283	7677	600 series	See appendix B heater tables
20510200 MAIN ENG HTR #2	283	7677	600 series	See appendix B heater tables
20510300 MAIN ENG HTR #3	283	7677	600 series	See appendix B heater tables
20520 SSME MFV HEATERS				FUNCTION: Maintain the SSME main fuel valve temperature at acceptable levels during recirc pump operation prior to lift off. USAGE: On during prelaunch until umbilical disconnect.

TABLE A-X.- MAIN PROPULSION SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
20520100 SSME MFV HTR 1	340	7677	None	Not used (GSE power)
20520200 SSME MFV HTR 2	340	7677	None	Not used (GSE power)
20520300 SSME MFV HTR 3	340	7677	None	Not used (GSE power)

A-XI 2100
OMS

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21010 VAP ISO VLVS LT POD				FUNCTION: Allow He flow to pressurize the oxidizer tank during OMS burns, and prevent propellant vapor mixing in the upstream system should propellant migration occur, through the check valves, between OMS burns. They are normally closed solenoid valves, located downstream of the pressure equalization line in the oxidizer pressurization leg. They are opened by the "engine on" signal from the GPC, with manual override capability to either open or close. The valves are parallel but both are powered during OMS burns. USAGE: Both valves are powered (open) for the full duration of each OMS burn. ANALYSIS USAGE:
21010100 VAP ISO VLV 1 LT POD	51	7677	301,311	On for the full duration of each OMS burn
21010200 VAP ISO VLV 2 LT POD	51	7677	301,311	On for the full duration of each OMS burn
21020 HE ISO VLVS LFT POD				FUNCTION: Allow He flow to the pressurization system during OMS burns and isolate the He tank from the two regulator legs of the pressurization system during non-thrusting periods. They are normally closed solenoid valves, opened by the "engine on" signal from the GPC, with manual override either open or closed. Both are powered during OMS burns.

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Both valves are powered (open) for the full duration of each OMS burn.
				ANALYSIS USAGE:
21020100 HE ISO VLV A LFT POD	73	7677	301,311	On for the full duration of each OMS burn
21020200 HE ISO VLV B LFT POD	73	7677	301,311	On for the full duration of each OMS burn
21030 VAP ISO VLVS RT POD				FUNCTION:
				Allow He flow to pressurize the oxidizer tank during OMS burns, and prevent propellant vapor mixing in the upstream system should propellant migration occur through the check valves, between OMS burns. They are normally closed solenoid valves, located downstream of the pressure equalization line in the oxidizer pressurization leg. They are opened by the "engine on" signal from the GPC, with manual override capability to either open or close. The valves are parallel but both are powered during OMS burns.
				USAGE:
				Both valves are powered (open) for the full duration of each OMS burn.
				ANALYSIS USAGE:
21030100 VAP ISO VLV 1 RT POD	51	7677	301,311	On for the full duration of each OMS burn
21030200 VAP ISO VLV 2 RT POD	51	7677	301,311	On for the full duration of each OMS burn

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21040 HE ISO VLVS RGT POD				FUNCTION: Allow He flow to the pressurization system during OMS burns and isolate the He tank from the two regulator legs of the pressurization system during non-thrusting periods. They are normally closed solenoid valves, opened by the "engine on" signal from the GPC, with manual override either open or closed. Both are powered during OMS burns. USAGE: Both valves are powered (open) for the full duration of each OMS burn. ANALYSIS USAGE:
21040100 HE ISO VLV A RGT POD	73	7677	301,311	On for the full duration of each OMS burn
21040200 HE ISO VLV B RGT POD	73	7677	301,311	On for the full duration of each OMS burn
21070 GIMBAL INSTR/LOGIC				FUNCTION: Provide power for the instrumentation and logic associated with the engine gimbal actuators. USAGE: All on continuously throughout all missions. ANALYSIS USAGE:
21070100 LP ACT GMBL INST/LOG	7	7677	101	On from pwr xfr int to EOM

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21070200 LP STB GMBL INST/LOG	7	7677	101	On from pwr xfr int to EOM
21070300 RP ACT GMBL INST/LOG	7	7677	101	On from pwr xfr int to EOM
21070400 RP STB GMBL INST/LOG	7	7677	101	On from pwr xfr int to EOM
21080 LP ACTUATORS				FUNCTION: This component represents the power to the motors which drive the engine gimbal actuators. The actuators control the thrust vector of the OMS engines in pitch and yaw. Each actuator is driven by one of two redundant motors, while the other motor is in standby. USAGE: · Burn Mode - On for the duration of each OMS burn. Slew Mode - On when driving the engine to a new position, if not burning. ANALYSIS USAGE:
21080100 LP PTH ACT GMBL BURN	60	7677	301,311	On for the full duration of each OMS burn
21080110 LP PTH ACT GMBL SLEW	181	7677	None	Not used
21080200 LP YAW ACT GMBL BURN	60	7677	301,311	On for the full duration of each OMS burn
21080210 LP YAW ACT GMBL SLEW	181	7677	None	Not used

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21080300 LP PTH STB GMBL BURN	60	7677	None	Not used (redundant equipment)
21080310 LP PTH STB GMBL SLEW	181	7677	None	Not used
21080400 LP YAW STB GMBL BURN	60	7677	None	Not used (redundant equipment)
21080410 LP YAW STB GMBL SLEW	181	7677	None	Not used
21090 RP ACTUATORS				FUNCTION: This component represents the power to the motors which drive the engine gimbal actuators. The actuators control the thrust vector of the OMS engines in pitch and yaw. Each actuator is driven by one of two redundant motors, while the other motor is in standby. USAGE: Burn Mode - On for the duration of each OMS burn. Slew Mode - On when driving the engine to a new position, if not burning. ANALYSIS USAGE:
21090100 RP PTH ACT GMBL BURN	60	7677	301,311	On for the full duration of each OMS burn
21090110 RP PTH ACT GMBL SLEW	181	7677	None	Not used
21090200 RP YAW ACT GMBL BURN	60	7677	301,311	On for the full duration of each OMS burn

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21090210 RP YAW ACT GMBL SLEW	181	7677	None	Not used
21090300 RP PTH STB GMBL BURN	60	7677	None	Not used (redundant equipment)
21090310 RP PTH STB GMBL SLEW	181	7677	None	Not used
21090400 RP YAW STB GMBL BURN	60	7677	None	Not used (redundant equipment)
21090410 RP YAW STB GMBL SLEW	181	7677	None	Not used
21100 FUEL TK ISO VLVS				FUNCTION: Isolate the fuel tank from the engine feed system when closed. They are located in parallel pairs at the outlet of each fuel tank. These are motor driven ball valves requiring momentary power to open or close. There is no software control unless auto crossfeed is incorporated. USAGE: Normally open, both closed for OMS Kit usage and for leak isolation (momentary power). ANALYSIS USAGE:
21100100 FUEL TK ISO VL A-LP	73	7677	None	Not used (contingency usage)
21100200 FUEL TK ISO VL B-LP	73	7677	None	Not used (contingency usage)

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21100300 FUEL TK ISO VL A-RP	73	7677	None	Not used (contingency usage)
21100400 FUEL TK ISO VL B-RP	73	7677	None	Not used (contingency usage)
21110 OXID TK ISO VLVS				FUNCTION: Isolate the oxidizer tank from the engine feed system when closed. They are located in parallel pairs at the outlet of each tank. These are motor driven ball valves requiring momentary power to open or close. There is no software control unless auto crossfeed is incorporated. USAGE: Normally open, both closed for OMS kit usage and for leak isolation (momentary power). ANALYSIS USAGE:
21110100 OXID TK ISO VL A-LP	73	7677	None	Not used (contingency usage)
21110200 OXID TK ISO VL B-LP	73	7677	None	Not used (contingency usage)
21110300 OXID TK ISO VL A-RP	73	7677	None	Not used (contingency usage)
21110400 OXID TK ISO VL B-RP	73	7677	None	Not used (contingency usage)
21120 FUEL CROSSFD VLVS				FUNCTION:

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Feed fuel to an interconnect/crossfeed manifold which supplies the other OMS engine or RCS engines. They are installed in parallel pairs between the propellant feedlines and the crossfeed lines. These are motor driven ball valves requiring momentary power (1.5 sec) to open or close. They are normally actuated by the crew but GPC actuated in aborts requiring an OMS crossfeed or OMS to RCS interconnect configuration.
				USAGE:
				Normally closed, both opened when OMS Kit propellant are being used, when OMS Propellant is being fed to RCS thrusters, or when an OMS engine has failed and propellant is being cross fed to the opposite engine (momentary power). In the event of an RTLS abort they will be actuated at powered pitch around.
				ANALYSIS USAGE:
21120100 FUEL CROSSFD VL A-LP	73	7677	051	STS-1 On to open for 1.5 sec at 3 hrs post deorbit rehearsal TIG and on to close for 1.5 sec at 4.5 hrs post deorbit rehearsal TIG
				STS-2 and OPS - Not used
21120200 FUEL CROSSFD VL B-LP	73	7677	051	STS-1 Same as 21120100
				STS-2 and OPS - Not used
21120300 FUEL CROSSFD VL A-RP	73	7677	None	Not used
21120400 FUEL CROSSFD VL B-RP	73	7677	None	Not used

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21130 OXID CROSSFD VLVS				FUNCTION: Feed oxidizer to an interconnect/crossfeed manifold which supplies the other OMS engine or RCS engines. They are installed in parallel pairs between the propellant feedlines and the crossfeed lines. These are motor driven ball valves requiring momentary power (1.5 sec) to open or close. They are normally actuated by the crew but GPC actuated in aborts requiring an OMS crossfeed or OMS to RCS interconnect configuration. USAGE: Normally closed; both opened when OMS kit propellants are being used, when OMS propellant is being fed to RCS thrusters, or when an OMS engine has failed and propellant is being cross fed to the opposite engine (momentary power). In the event of an RTLS abort they will be actuated at powered pitch around. ANALYSIS USAGE:
21130100 OXID CROSSFD VL A-LP	73	7677	051	STS-1 On to open for 1.5 sec at 3 hrs post deorbit rehearsal TIG and on to close for 1.5 sec at 4.5 hrs post deorbit rehearsal TIG STS-2 and OPS - Not used
21130200 OXID CROSSFD VL B-LP	73	7677	051	STS-1 Same as 21130100 STS-2 and OPS - Not used
21130300 OXID CROSSFD VL A-RP	73	7677	None	Not used

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21130400 OXID CROSSFD VL B-RP	73	7677	None	Not used
21150 BI PROP VLV POS IND				FUNCTION: Monitors the position of the bi-propellant valves USAGE: Indicators are on from pwr xfr to EOM. ANALYSIS USAGE:
21150100 BIPROP VL1 LP POS ID	1	7677	101	On from pwr xfr to EOM
21150200 BIPROP VL2 LP POS ID	1	7677	101	Same as 21150100
21150300 BIPROP VL1 RP POS ID	1	7677	101	Same as 21150100
21150400 BIPROP VL2 RP POS ID	1	7677	101	Same as 21150100
21210 VALVE TALKBACKS				FUNCTION: Indicates open or closed position of valve. USAGE: On continuously throughout all missions. ANALYSIS USAGE:
21210200 (8) HE/VAP VLV TALKBACK	<1	7677	None	Not used
21210300 (2) ENG PRESS VLV TLKBCK	<1	7677	None	Not used

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21210400 (4) ENG CNTL VLV TLKBCK	1	7677	None	Not used
21210500 (4) ENG PURG VLV TLKBCK	1	7677	None	Not used
21210600 (16) TK ISO/XFD VL TLKBCK	1	7677	None	Not used (low power)
21240 QUANTITY GAGES				FUNCTION: Sense the quantity remaining in each of the propellant tanks. The signals are used for crew display and for a tank depletion indication to the GPC. These are capacitance probes. USAGE: Operate Mode - On for the full duration of each OMS burn. Idle Mode - On continuously throughout the mission except when in operate. ANALYSIS USAGE:
21240100 QUAN GAGE TOT-LP-OPR	30	7677	301,311	On for the full duration of each OMS burn
21240110 QUAN GAGE TOT-LP-IDL	10	7677	101	On from pwr xfr int to EOM except when in the Operate mode
21240200 QUAN GAGE TOT-RP-OPR	30	7677	301,311	On for the full duration of each OMS burn
21240210 QUAN GAGE TOT-RP-IDL	10	7677	101	On from pwr xfr int to EOM except when in the Operate

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	FF	ACTIVITY BLOCKS	FUNCTION & USAGE
				mode
21250 ENG PRESU V COILS LP				FUNCTION: Actuate normally closed solenoid valves which provide pneumatic pressure to the engine control valves. The solenoid valves have redundant coils, both of which are powered when open. If a valve fails to open, sufficient pneumatics are available for only one subsequent burn of that OMS engine. USAGE: On from 2 min prior to lift-off through OMS-1 and then on from 2 min prior to each OMS burn until the end of the burn. ANALYSIS USAGE:
21250100 ENG PRESU V COIL 1 LP	33	7677	123,301,311	On from 2 min prior to lift-off through OMS-1 and then on from 2 min prior to each OMS burn until the end of the burn.
21250200 ENG PRESU V COIL 2 LP	33	7677	123,301,311	On from 2 min prior to lift-off through OMS-1 and then on from 2 min prior to each OMS burn until the end of the burn.
21260 ENG PRESU V COILS RP	33			FUNCTION: Actuate normally closed solenoid valves which provide pneumatic pressure to the engine control valves. The solenoid valves have redundant coils, both of which are powered when open. If a valve fails to open, suffi-

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				cient pneumatics are available for only one subsequent burn of that OMS engine. USAGE: On from 2 min prior to lift-off through OMS-1 and then on from 2 min prior to each OMS burn until the end of the burn.
21260100 ENG PRESU V COIL 1 RP	33	7677	123,301,311	ANALYSIS USAGE: On from 2 min prior to lift-off through OMS-1 and then on from 2 min prior to each OMS burn until the end of the burn.
21260200 ENG PRESU V COIL 2 RP	33	7677	123,301,311	On from 2 min prior to lift-off through OMS-1 and then on from 2 min prior to each OMS burn until the end of the burn.
21270 ENG CTL V 1 COILS LP				FUNCTION: Actuate normally closed solenoid valves which supply pneumatics to open the propellant feed ball valves. The solenoid valves have redundant coils, both of which are powered when open. Failure of a valve to open causes loss of an OMS engine. These valves are opened by the "engine on" signal from the GPC. USAGE: On for the full duration of each OMS burn.

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
21270100 ENG CTL V 1 COIL 1 LP	33	7677	301,311	On for the full duration of each OMS burn
21270200 ENG CTL V 1 COIL 2 LP	33	7677	301,311	On for the full duration of each OMS burn
21280 ENG CTL V 2 COILS LP				FUNCTION: Actuate normally closed solenoid valves which supply pneumatics to open the propellant feed ball valves. The solenoid valves have redundant coils, both of which are powered when open. Failure of a valve to open causes loss of an OMS engine. These valves are opened by the "engine on" signal from the GPC.
				USAGE: On for the full duration of each OMS burn.
				ANALYSIS USAGE:
21280100 ENG CTL V 2 COIL 1 LP	33	7677	301,311	On for the full duration of each OMS burn
21280200 ENG CTL V 2 COIL 2 LP	33	7677	301,311	On for the full duration of each OMS burn
21290 ENG CTL V 1 COILS RP				FUNCTION: Actuate normally closed solenoid valves which supply pneumatics to open the propellant feed ball valves. The solenoid valves have redundant coils, both of which are powered when open. Failure of a valve to open causes loss of an OMS engine. These valves are opened by the "engine on" signal from the GPC.

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				On for the full duration of each OMS burn.
				ANALYSIS USAGE:
21290100 ENG CTL V 1 COIL 1 RP	33	7677	301,311	On for the full duration of each OMS burn
21290200 ENG CTL V 1 COIL 2 RP	33	7677	301,311	On for the full duration of each OMS burn
21300 ENG CTL V 2 COILS RP				FUNCTION:
				Actuate normally closed solenoid valves which supply pneumatics to open the propellant feed ball valves. The solenoid valves have redundant coils, both of which are powered when open. Failure of a valve to open causes loss of an OMS engine. These valves are opened by the "engine on" signal from the GPC.
				USAGE:
				On for the full duration of each OMS burn.
				ANALYSIS USAGE:
21300100 ENG CTL V 2 COIL 1 RP	33	7677	301,311	On for the full duration of each OMS burn
21300200 ENG CTL V 2 COIL 2 RP	33	7677	301,311	On for the full duration of each OMS burn
21330 ENGINE PURGE VLVS				FUNCTION:
				Allows GN_2 flow to purge fuel line at OMS burn cutoff. They are normally closed solenoid valves in series

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				opened by signals from the GPC.
				USAGE:
				Both on for 2 sec following each OMS burn.
				ANALYSIS USAGE:
21330[illegible] (2) ENGINE PURGE VLVE-LP	66	7677	301,311	Both on for 2 sec following each OMS burn
21330200 (2) ENGINE PURGE VLVE-RP	66	7677	301,311	Both on for 2 sec following each OMS burn
21340 GN2 FILL/VENT VLV				FUNCTION:
				Used to fill GN2 tanks approximately 20 hrs prior to launch.
				USAGE:
				Used 20 hrs prior to launch. Controlled by prelaunch MDM; therefore, cannot be used in flight.
				ANALYSIS USAGE:
21340100 GN2 FILL/VENT VLV-LP	51	7677	None	Not used (GSE usage)
21340200 GN2 FILL/VENT VLV-RP	51	7677	None	Not used (GSE usage)
21510 OMS/RCS PRP HT LP				FUNCTION:
				Maintain the components in the OMS/RCS pods above 40 deg F. These are radiant area heaters. The A and B heaters are redundant and may be enabled or disabled

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				independently.
				USAGE:
				Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, some heaters may cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, these heaters will be disabled until after seat egress, then again for descent.
				ANALYSIS USAGE:
21510100 GSE SR PN HT A-43-LP	43	7677	Asc, 600 series	See appendix B heater tables
21510200 ENG SR PN HT A-37-LP	64	7677	600 series	See appendix B heater tables
21510300 OME COVER HT A-53-LP	108	7677	Asc, 600 series	See appendix B heater tables
21510400 Y-WB OTBD HT A-27-LP	108	7677	Asc, 600 series	See appendix B heater tables
21510500 Y-WB INBD HT A-33-LP	108	7677	Asc, 600 series	See appendix B heater tables
21510600 Y-WB UPR HT A-31-LP	108	7677	600 series	See appendix B heater tables
21510700				

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
CT LN WB HT A1-21-LP	202	7677	Asc, 600 series	See appendix B heater tables
21510800 CT LN WB HT A2-21-LP	213	7677	Asc, 600 series	See appendix B heater tables
21510900 CT LN WB HT A3-21-LP	106	7677	Asc, 600 series	See appendix B heater tables
21511100 CT LN WB HT A4-21-LP	218	7677	Asc, 600 series	See appendix B heater tables
21511200 RCS HSNG HT A1-41-LP	118	7677	Asc, 600 series	See appendix B heater tables
21511300 RCS HSNG HT A2-41-LP	102	7677	Asc, 600 series	See appendix B heater tables
21520 OMS/RCS PRP HT LP				FUNCTION: Maintain the components in the OMS/RCS pods above 40 deg F. These are radiant area heaters. The A and B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, some heaters may cycle during ascent depending upon prelaunch purge temperatures.

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Otherwise, duty cycles are a function of attitude and beta angle. For most missions, these heaters will be disabled until after seat egress, then again for descent.
				ANALYSIS USAGE:
21520100 GSE SR PN HT B-51-LP	43	7677	None	Not used (redundant equipment)
21520200 ENG SR PN HT B-39-LP	64	7677	None	Not used (redundant equipment)
21520300 OME COVE. HT B-55-LP	108	7677	None	Not used (redundant equipment)
21520400 Y-WB OTBD HT B-25-LP	108	7677	None	Not used (redundant equipment)
21520500 Y-WB INBD HT B-35-LP	108	7677	None	Not used (redundant equipment)
21520600 Y-WB UPR HT B-29-LP	108	7677	None	Not used (redundant equipment)
21520700 CT LN WB HT B1-23-LP	202	7677	None	Not used (redundant equipment)
21520800 CT LN WB HT B2-23-LP	213	7677	None	Not used (redundant equipment)
21520900 CT LN WB HT B3-23-LP	106	7677	None	Not used (redundant equipment)
21521100 CT LN WB HT B4-23-LP	218	7677	None	Not used (redundant equipment)
21521200				

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
RCS HSNG HT B1-45-LP	118	7677	None	Not used (redundant equipment)
21521300 RCS HSNG HT B2-45-LP	102	7677	None	Not used (redundant equipment)
21530 OMS/RCS PRP HT RP				FUNCTION: Maintain the components in the OMS/RCS pods above 40 deg F. These are radiant area heaters. The A and B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, some heaters may cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, these heaters will be disabled until after seat egress, then again for descent. ANALYSIS USAGE:
21530100 GSE SR PN HT A-44-RP	43	7677	Asc, 600 series	See appendix B heater tables
21530200 ENG SR PN HT A-38-RP	64	7677	600 series	See appendix B heater tables
21530300 OME COVER HT A-54-RP	108	7677	Asc, 600 series	See appendix B heater tables
21530400				

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
Y-WB OTBD HT A-28-RP	108	7677	Asc, 600 series	See appendix B heater tables
21530500 Y-WB INBD HT A-34-RP	108	7677	Asc, 600 series	See appendix B heater tables
21530600 Y-WB UPR HT A-32-RP	108	7677	600 series	See appendix B heater tables
21530700 CT LN WB HT A1-22-RP	202	7677	Asc, 600 series	See appendix B heater tables
21530800 CT LN WB HT A2-22-RP	213	7677	Asc, 600 series	See appendix B heater tables
21530900 CT LN WB HT A3-22-RP	106	7677	Asc, 600 series	See appendix B heater tables
21531100 CT LN WB HT A4-22-RP	218	7677	Asc, 600 series	See appendix B heater tables
21531200 RCS HSNG HT A1-42-RP	118	7677	Asc, 600 series	See appendix B heater tables
21531300 RCS HSNG HT A2-42-RP	102	7677	Asc, 600 series	See appendix B heater tables
21540 OMS/RCS PRP HT RP				FUNCTION: Maintain the components in the OMS/RCS pods above 40

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				deg F. These are radiant area heaters. The A and B heaters are redundant and may be enabled or disabled independently.
				USAGE:
				Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, some heaters may cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, these heaters will be be disabled until after seat egress, then again for descent.
				ANALYSIS USAGE:
21540100 GSE SR PN HT B-52-RP	43	7677	None	Not used (redundant equipment)
21540200 ENG SR PN HT B-40-RP	64	7677	None	Not used (redundant equipment)
21540300 OME COVER HT B-56-RP	108	7677	None	Not used (redundant equipment)
21540400 Y-WB OTBD HT B-26-RP	108	7677	None	Not used (redundant equipment)
21540500 Y-WB INBD HT B-36-RP	108	7677	None	Not used (redundant equipment)
21540600 Y-WB UPR HT B-30-RP	108	7677	None	Not used (redundant equipment)
21540700 CT LN WB HT B1-24-RP	202	7677	None	Not used (redundant equipment)

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21540800 CT LN WB HT B2-24-RP	213	7677	None	Not used (redundant equipment)
21540900 CT LN WB HT B3-24-RP	106	7677	None	Not used (redundant equipment)
21541100 CT LN WB HT B4-24-RP	218	7677	None	Not used (redundant equipment)
21541200 RCS HSNG HT B1-46-RP	118	7677	None	Not used (redundant equipment)
21541300 RCS HSNG HT B2-46-RP	102	7677	None	Not used (redundant equipment)
21700 CROSSFED OX/FU FLEX LINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE:
21700100 XFD OX/FU FLXL HTA-L	36	7677	Asc, Des, 600 series	See appendix B heater tables

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21700200 XFD OX/FU FLXL HTB-L	36	7677	None	Not used (redundant equipment)
21700300 XFD OX/FU FLXL HTA-R	36	7677	Asc, Des, 600 series	See appendix B heater tables
21700400 XFD OX/FU FLXL HTB-R	36	7677	None	Not used (redundant equipment)
21710 CROSSFEED OX/FU LINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, or a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise duty cycles are a funcion of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE:
21710100 XFD OX/FU LNE HT-A-L	62	7677	Asc, Des, 600 series	See appendix B heater tables
21710200 XFD OX/FU LNE HT-B-L	62	7677	None	Not used (redundant equipment)

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21540800 CT LN WB HT B2-24-RP	213	7677	None	Not used (redundant equipment)
21540900 CT LN WB HT B3-24-RP	106	7677	None	Not used (redundant equipment)
21541100 CT LN WB HT B4-24-RP	218	7677	None	Not used (redundant equipment)
21541200 RCS HSNG HT B1-46-RP	118	7677	None	Not used (redundant equipment)
21541300 RCS HSNG HT B2-46-RP	102	7677	None	Not used (redundant equipment)
21700 CROSSFED OX/FU FLEX LINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE: See appendix B heater tables
21700100 XFD OX/FU FLXL HTA-L	36	7677	Asc, Des, 600 series	

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21700200 XFD OX/FU FLXL HTB-L	36	7677	None	Not used (redundant equipment)
21700300 XFD OX/FU FLXL HTA-R	36	7677	Asc, Des, 600 series	See appendix B heater tables
21700400 XFD OX/FU FLXL HTB-R	36	7677	None	Not used (redundant equipment)
21710 CROSSFEED OX/FU LINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, or a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise duty cycles are a funcion of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE:
21710100 XFD OX/FU LNE HT-A-L	62	7677	Asc, Des, 600 series	See appendix B heater tables
21710200 XFD OX/FU LNE HT-B-L	62	7677	None	Not used (redundant equipment)

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21710300 XFD OX/FU LNE HT-A-R	62	7677	Asc, Des, 600 series	See appendix B heater tables
21710400 XFD OX/FU LNE HT-B-R	62	7677	None	Not used (redundant equipment)
21710500 XFD OX/FU LNE HT-A-C	90	7677	Asc, Des, 600 series	See appendix B heater tables
21710600 XFD OX/FU LNE HT-B-C	90	7677	None	Not used (redundant equipment)
21720 FUEL HI POINT BLEEDLINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE:
21720100 FU HIPT BLDLN HT-A-A	15	7677	Asc, Des, 600 series	See appendix B heater tables

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
21720200 FU HIPT BLDLN HT-B-A	15	7677	None	Not used (redundant equipment)
21720300 FU HIPT BLDLN HT-A-M	24	7677	Asc, Des, 600 series	See appendix B heater tables
21720400 FU HIPT BLDLN HT-B-M	24	7677	None	Not used (redundant equipment)
21730 OXID HI POINT BLEEDLINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE:
21730100 OX HIPT BLDLN HT-A-A	15	7677	Asc, Des, 600 series	See appendix B heater tables
21730200 OX HIPT BLDLN HT-B-A	15	7677	None	Not used (redundant equipment)
21730300				

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
OX HIPT BLDLN HT-A-M	24	7677	Asc. Des, 600 series	See appendix B heater tables
21730400 OX HIPT BLDLN HT-B-M	24	7677	None	Not used (redundant equipment)
21740 LO POINT OXID/FUEL DRAINLINE HEATERS				FUNCTION: Maintain the propellant line temperatures in an acceptable range to prevent freezing. The A&B heaters are redundant and may be enabled or disabled independently. USAGE: Heaters are thermostatically controlled but may be enabled or disabled, as a group, from the aft station. When enabled prelaunch, most heaters will cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or system B will be enabled continuously. ANALYSIS USAGE:
21740100 LOPT OXFU DRLN HTA-L	8	7677	Asc, Des, 600 series	See appendix B heater tables
21740200 LOPT OXFU DRLN HTB-L	8	7677	None	Not used (redundant equipment)
21740300 LOPT OXFU DRLN HTA-R	8	7677	Asc, Des, 600 series	See appendix B heater tables
21740400				

TABLE A-XI.- ORBITAL MANEUVERING SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
LOPT OXFU DRLN HTB-R	8	7677	None	Not used (redundant equipment)

A-XII 2200
RCS

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22010 FORWARD THRUSTERS				FUNCTION: Provide primary thrust for reaction control. There are 14 thrusters which are controlled by computers through the Reaction Jet Drivers - Fwd. As many as 4 of these may be on simultaneously. USAGE: First used to establish attitude for ET separation. Subsequently used during orbital operations for attitude control, attitude maneuvers and small translation burns. Not used after fwd RCS deactivation which occurs shortly following deorbit burn. Duty cycle TBD. ANALYSIS USAGE:
22010100 FWD THRUSTER F1F(-X)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501	On at a 0.15% usage factor from insertion to deorbit; on at a 25% usage factor for RCS maneuvers; and on at a 0.5% usage factor from MECO + 20 sec until insertion, from 10 min prior to thru end of OMS maneuvers for stationkeeping, docking, undocking, and payload handling, and from 30 min prior to deorbit until 10 min following deorbit
22010200 FWD THRUSTER F1L(+Y)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22010300 FWD THRUSTER F1U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22010400 FWD THRUSTER F1D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22010500 FWD THRUSTER F2F(-X)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501	Same as 22010100
22010600 FWD THRUSTER F2R(-Y)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22010700 FWD THRUSTER F2U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22010800 FWD THRUSTER F2D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22010900 FWD THRUSTER F3F(-X)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501	Same as 22010100
22011 FORWARD THRUSTERS				FUNCTION: See 22010. USAGE: See 22010. ANALYSIS USAGE:
22011100 FWD THRUSTER F3L(+Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501	Same as 22010100
22011200				

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FWD THRUSTER F3U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22011300 FWD THRUSTER F3D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22011400 FWD THRUSTER F4R(-Y)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22011500 FWD THRUSTER F4D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22020 AFT THRUSTERS				FUNCTION: Provide primary thrust for reaction control. There are 24 thrusters which are controlled by computers through the Reaction Jet Drivers - Aft. As many as 6 of these may be on simultaneously. USAGE: First used to establish attitude for ET separation. Subsequently used during orbital operations for attitude control, attitude maneuvers, and small translation burns. Also used for descent to MACH 1 (approx 50,000 ft). Duty cycle TBD. ANALYSIS USAGE:
22020100 AFT THRUSTER R1R(-Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501,503	On at a 0.20% usage factor from insertion to deorbit; on at a 33.3% usage factor for RCS maneuvers; and on at a 0.667% usage factor from MECO + 20 sec to insertion, from 10 min prior to thru end of OMS maneuvers,

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				for stationkeeping, docking, undocking, and payload handling, and from 30 min prior to deorbit until 4 min prior to TD
22020200 AFT THRUSTER R1U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22020300 AFT THRUSTER R1A(+X)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22020400 AFT THRUSTER R2R(-Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501,503	Same as 22020100
22020500 AFT THRUSTER R2D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22020600 AFT THRUSTER R2U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22020700 AFT THRUSTER R3R(-Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501,503	Same as 22020100
22020800 AFT THRUSTER R3D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22020900 AFT THRUSTER R3A(+X)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22021 AFT THRUSTERS				FUNCTION: See 22020. USAGE: See 22020. ANALYSIS USAGE:
22021100 AFT THRUSTER R4R(-Y)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22021200 AFT THRUSTER R4D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22021300 AFT THRUSTER R4U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22021400 AFT THRUSTER L1L(+Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501,503	Same as 22020100
22021500 AFT THRUSTER L1U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22021600 AFT THRUSTER L1A(+X)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22021700 AFT THRUSTER L2L(+Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501,503	Same as 22020100
22021800 AFT THRUSTER L2D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22021900 AFT THRUSTER L2U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22022 AFT THRUSTERS				FUNCTION: See 22020. USAGE: See 22020. ANALYSIS USAGE:
22022100 AFT THRUSTER L3L(+Y)	71	7677	205,301,303, 305,309,405, 411,413,451, 453,501,503	Same as 22020100
22022200 AFT THRUSTER L3D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22022300 AFT THRUSTER L3A(+X)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22022400 AFT THRUSTER L4L(+Y)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
220225000 AFT THRUSTER L4D(-Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22022600 AFT THRUSTER L4U(+Z)	71	7677	None	Not used (energy consumption accounted for by usage factor of other units)
22030 FORWARD VERNIER THRUSTERS				FUNCTION: Provide vernier thrust for reaction control. There are 2 thrusters which are controlled by the GPC's through the Reaction Jet Drivers - Fwd. USAGE: Used for attitude hold during experiment operations requiring narrow deadband. Duty cycle TBD.
22030100 FWD VER THRS F5L	35	7677	None	ANALYSIS USAGE: Not used
22030200 FWD VER THRS F5R	35	7677	None	Not used
22040 AFT VERNIER THRUSTERS				FUNCTION: Provide vernier thrust for reaction control. There are 4 thrusters which are controlled by the GPC's through the Reaction Jet Drivers - Aft.

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Used for attitude hold during experiment operations requiring narrow deadband. Duty cycle TBD.
				ANALYSIS USAGE:
22040100 AFT VER THRS R5D(-Z)	35	7677	None	Not used
22040200 AFT VER THRS R5R(-Y)	35	7677	None	Not used
22040300 AFT VER THRS L5D(-Z)	35	7677	None	Not used
22040400 AFT VER THRS L5L(+Y)	35	7677	None	Not used
22060 HELIUM ISOLATION VALVES-FORWARD				FUNCTION:
				Isolate the helium pressurant from the parallel redundant regulators when closed. These are normally closed valves, magnetically latched open, requiring momentary power to open or close. There are two valves for the oxidizer system and two for the fuel system per pod. The actuation time to either open or close the values is approx 250 ms.
				USAGE:
				All four valves are manually opened 20 min prior to lift-off and remain open through OMS-2 cutoff at which time two are closed (B valves). The remaining pair remain open until forward RCS deactivation approximately 5 min after the deorbit burn at which time

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				they are closed (A valves). Otherwise, they are closed only in the event of a contingency.
				ANALYSIS USAGE:
22060100 HE OX ISO V A FWD-OP	37	7677	None	Not used (contingency usage)
22060210 HE OX ISO V A FWD-CL	37	7677	None	Not used (momentary power)
22060300 HE OX ISO V B FWD-OP	37	7677	None	Not used (contingency usage)
22060410 HE OX ISO V B FWD-CL	37	7677	None	Not used (momentary power)
22060500 HE FU ISO V A FWD-OP	37	7677	None	Not used (contingency usage)
22060610 HE FU ISO V A FWD-CL	37	7677	None	Not used (momentary power)
22060700 HE FU ISO V B FWD-OP	37	7677	None	Not used (contingency usage)
22060810 HE FU ISO V B FWD-CL	37	7677	None	Not used (momentary power)
22070 HELIUM ISOLATION VALVES-LEFT AFT				FUNCTION:
				Isolate the helium pressurant from the parallel redundant regulators when closed. These are normally closed valves, magnetically latched open, requiring momentary power to open or close. There are two valves for the oxidizer system and two for the fuel

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				system per pod. The actuation time to either open or close the valves is approx 250 ms.
				USAGE:
				All four valves are opened manually at T - 20 min and remain open thru OMS-2 cutoff. Two are then closed (B valves) manually for the remainder of the mission. Otherwise they are closed only in the event of a contingency.
				ANALYSIS USAGE:
22070100 HE OX IS V A LAFT-OP	37	7677	None	Not used (contingency usage)
22070210 HE OX IS V A LAFT-CL	37	7677	None	Not used (contingency usage)
22070300 HE OX IS V B LAFT-OP	37	7677	None	Not used (contingency usage)
22070410 HE OX IS V B LAFT-CL	37	7677	None	Not used (momentary power)
22070500 HE FU IS V A LAFT-OP	37	7677	None	Not used (contingency usage)
22070610 HE FU IS V A LAFT-CL	37	7677	None	Not used (contingency usage)
22070700 HE FU IS V B LAFT-OP	37	7677	None	Not used (contingency usage)
22070810 HE FU IS V B LAFT-CL	37	7677	None	Not used (momentary power)
22080				

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
HELIUM ISOLATION VALVES - RIGHT AFT				FUNCTION: Isolate the helium pressurant from the parallel redundant regulators when closed. These are normally closed valves, magnetically latched open, requiring momentary power to open or close. There are two valves for the oxidizer system and two for the fuel system per pod. The actuation time for each valve is 250 m sec for either the open or closed position. USAGE: All four valves are opened at T - 20 min and remain open thru OMS-2 cutoff. Two are then closed (B valves) manually for the remainder of the mission. Otherwise they are closed only in the event of a contingency. ANALYSIS USAGE:
22080100 HE OX IS V A RAFT-OP	37	7677	None	Not used (contingency usage)
22080210 HE OX IS V A RAFT-CL	37	7677	None	Not used (contingency usage)
22080300 HE OX IS V B RAFT-OP	37	7677	None	Not used (contingency usage)
22080410 HE OX IS V B RAFT-CL	37	7677	None	Not used (momentary power)
22080500 HE FU IS V A RAFT-OP	37	7677	None	Not used (contingency usage)
22080610 HE FU IS V A RAFT-CL	37	7677	None	Not used (contingency usage)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22080700 HE FU IS V B RAFT-OP	37	7677	None	Not used (contingency usage)
22080810 HE FU IS V B RAFT-CL	37	7677	None	Not used (momentary power)
22090 TANK ISOLATION VALVES-FORWARD				FUNCTION: Isolate the propellant tanks from the manifold isolation valves. This provides redundant shutoff capability in case of a leak or failed open thruster. These are motor driven ball valves, requiring momentary power to open or close. The actuation time to either open or close the valves is 1.5 sec. USAGE: All valves are opened at T - 20 min and remain open throughout all missions. They are closed only in the event of a contingency. ANALYSIS USAGE:
22090100 OX TK ISO VL 1-2 FWD	73	7677	None	Not used (contingency usage)
22090200 FU TK ISO VL 1-2 FWD	73	7677	None	Not used (contingency usage)
22090300 OX TK ISO VL 3-5 FWD	73	7677	None	Not used (contingency usage)
22090400 FU TK ISO VL 3-5 FWD	73	7677	None	Not used (contingency usage)
22100				

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
TANK ISOLATION VALVES-LEFT AFT				FUNCTION: Isolate the propellant tanks from the manifold isolation valves. This provides redundant shutoff capability in case of a leak or failed open thruster. These are motor driven ball valves, requiring momentary power to open or close. The actuation time to either open or close the valves is 1.5 sec. USAGE: All valves are opened by the crew at T - 20 min and remain open throughout all missions. They are closed nominally for crossfeed and interconnect operations and in the event of a contingency. They are actuated automatically by the GPC in the event of an RTLS abort; closed at start of OMS PRPLT dump and opened at OMS dump termination. ANALYSIS USAGE:
22100100 OX TK ISO VL 1-2 LA	73	7677	051	STS-1 - On for 1.5 sec at 3 hrs after deorbit rehearsal TIG; and on for 1.5 sec at 4.5 hrs after deorbit rehearsal TIG STS-2 - Not used (contingency usage) OPS - Not used (contingency usage)
22100200 FU TK ISO VL 1-2 LA	73	7677	051	STS-1 - On for 1.5 sec at 3 hrs after deorbit rehearsal TIG; and on for 1.5 sec at 4.5 hrs after deorbit rehearsal TIG STS-2 - Not used (contingency usage)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Not used (contingency usage)
22100300 OX TK ISO V 3-5 A-LA	73	7677	051	STS-1 - Same as 22100100
				STS-2 - Same as 22100100
				OPS - Same as 22100100
22100400 FU TK ISO V 3-5 A-LA	73	7677	051	STS-1 - Same as 22100200
				STS-2 - Same as 22100200
				OPS - Same as 22100200
22100500 OX TK ISO V 3-5 B-LA	73	7677	051	STS-1 - Same as 22100100
				STS-2 - Same as 22100100
				OPS - Same as 22100100
22100600 FU TK ISO V 3-5 B-LA	73	7677	051	STS-1 - Same as 22100200
				STS-2 - Same as 22100200
				OPS - Same as 22100200
22110 TANK ISOLATION VALVES-RIGHT AFT				FUNCTION: Isolate the propellant tanks from the manifold isolation valves. This provides redundant shutoff capability in case of a leak or failed open thruster.

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				These are motor driven ball valves, requiring momentary power to open or close. The actuation time to either open or close the valves is 1.5 sec.
				USAGE:
				All valves are opened by the crew at T - 20 min and remain open throughout all missions. They are closed nominally for crossfeed and interconnect operations and in the event of a contingency. They are actuated automatically by the GPC in the event of an RTLS abort; closed at start of OMS PRPLT dump and opened at OMS dump termination.
				ANALYSIS USAGE:
22110100 OX TK ISO VL 1-2 RA	73	7677	051	STS-1 - Same as 22100100
				STS-2 - Same as 22100100
				OPS - Same as 22100100
22110200 FU TK ISO VL 1-2 RA	73	7677	051	STS-1 - Same as 22100200
				STS-2 - Same as 22100200
				OPS - Same as 22100200
22110300 OX TK ISO V 3-5 A-RA	73	7677	051	STS-1 - Same as 22100100
				STS-2 - Same as 22100100
				OPS - Same as 22100100
22110400				

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FU TK ISO V 3-5 A-RA	73	7677	051	STS-1 - Same as 22100200 STS-2 - Same as 22100200 OPS - Same as 22100200
22110500 OX TK ISO V 3-5 B-RA	73	7677	051	STS-1 - Same as 22100100 STS-2 - Same as 22100100 OPS - Same as 22100100
22110600 FU TK ISO V 3-5 B-RA	73	7677	051	STS-1 - Same as 22100200 STS-2 - Same as 22100200 OPS - Same as 22100200
22120 MANIFOLD ISOLATION VALVES-FORWARD				FUNCTION: Provide the capability to isolate leaks or failed open thrusters. They are located in the primary thruster propellant manifolds for each tank, downstream from the tank isolation valves. These are motor driven ball valves, requiring momentary power to open or close. USAGE: All valves are opened at T - 20 min and remain open throughout all missions. They are closed only in the event of a contingency.

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
22120100 MANF 1 OX ISO VL FWD	73	7677	None	Not used (contingency usage)
22120200 MANF 1 FU ISO VL FWD	73	7677	None	Not used (contingency usage)
22120300 MANF 2 OX ISO VL FWD	73	7677	None	Not used (contingency usage)
22120400 MANF 2 FU ISO VL FWD	73	7677	None	Not used (contingency usage)
22120500 MANF 3 OX ISO VL FWD	73	7677	None	Not used (contingency usage)
22120600 MANF 3 FU ISO VL FWD	73	7677	None	Not used (contingency usage)
22120700 MANF 4 OX ISO VL FWD	73	7677	None	Not used (contingency usage)
22120800 MANF 4 FU ISO VL FWD	73	7677	None	Not used (contingency usage)
22120900 MNF 5 OX ISOV FWD-OP	51	7677	None	Not used (contingency usage)
22121110 MNF 5 OX ISOV FWD-CL	51	7677	None	Not used (contingency usage)
22121200 MNF 5 FU ISOV FWD-OP	51	7677	None	Not used (contingency usage)
22121310 MNF 5 FU ISOV FWD-CL	51	7677	None	Not used (contingency usage)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22130 MANIFOLD ISOLATION VALVES-LEFT AFT				FUNCTION: Provide the capability to isolate leaks or failed open thrusters. They are located in the primary thruster propellant manifolds for each tank, downstream from the tank isolation valves. These are motor driven ball valves, requiring momentary power to open or close. USAGE: All valves are opened at T - 20 min and remain open throughout all missions. They are closed only in the event of a contingency. ANALYSIS USAGE:
22130100 MANF 1 OX ISO VLV LA	73	7677	None	Not used (contingency usage)
22130200 MANF 1 FU ISO VLV LA	73	7677	None	Not used (contingency usage)
22130300 MANF 2 OX ISO VLV LA	73	7677	None	Not used (contingency usage)
22130400 MANF 2 FU ISO VLV LA	73	7677	None	Not used (contingency usage)
22130500 MANF 3 OX ISO VLV LA	73	7677	None	Not used (contingency usage)
22130600 MANF 3 FU ISO VLV LA	73	7677	None	Not used (contingency usage)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22130700 MANF 4 OX ISO VLV LA	73	7677	None	Not used (contingency usage)
22130800 MANF 4 FU ISO VLV LA	73	7677	None	Not used (contingency usage)
22130900 MNF 5 OX ISOV LA-OP	51	7677	None	Not used (contingency usage)
22131110 MNF 5 OX ISOV LA-CL	51	7677	none	Not used (contingency usage)
22131200 MNF 5 FU ISOV LA-OP	51	7677	None	Not used (contingency usage)
22131310 MNF 5 FU ISOV LA-CL	51	7677	None	Not used (contingency usage)
22140 MANIFOLD ISOLATION VALVES-RIGHT AFT				FUNCTION: Provide the capability to isolate leaks or failed open thrusters. They are located in the primary thruster propellant manifolds for each tank, downstream from the tank isolation valves. These are motor driven ball valves, requiring momentary power to open or close. USAGE: All valves are opened at T - 20 min and remain open throughout all missions. They are closed only in the event of a contingency. ANALYSIS USAGE:

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22140100 MANF 1 OX ISO VLV RA	73	7677	None	Not used (contingency usage)
22140200 MANF 1 FU ISO VLV RA	73	7677	None	Not used (contingency usage)
22140300 MANF 2 OX ISO VLV RA	73	7677	None	Not used (contingency usage)
22140400 MANF 2 FU ISO VLV RA	73	7677	None	Not used (contingency usage)
22140500 MANF 3 OX ISO VLV RA	73	7677	None	Not used (contingency usage)
22140600 MANF 3 FU ISO VLV RA	73	7677	None	Not used (contingency usage)
22140700 MANF 4 OX ISO VLV RA	73	7677	None	Not used (contingency usage)
22140800 MANF 4 FU ISO VLV RA	73	7677	None	Not used (contingency usage)
22140900 MNF 5 OX ISOV RA-OP	51	7677	None	Not used (contingency usage)
22141110 MNF 5 OX ISOV RA-CL	51	7677	None	Not used (contingency usage)
22141200 MNF 5 FU ISOV RA-OP	51	7677	None	Not used (contingency usage)
22141310 MNF 5 FU ISOV RA-CL	51	7677	None	Not used (contingency usage)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22250 CROSSFEED VALVES - LEFT AFT				FUNCTION: Provide for propellant transfer between aft RCS pods, or feed OMS propellant to aft RCS engines. These are motor driven ball valves requiring only momentary power to open or close. The actuation time to either open or close the valve is 1.5 sec. USAGE: The normally closed valves are all opened by crew for RCS crossfeed operation or when OMS propellant is being fed to RCS engines. For RTLS aborts, the GPC automatically actuates valves open pre-dump and closes them post dump. ANALYSIS USAGE:
22250100 OX XFEED VLV 1-2 LA	73	7677	051	STS-1 - On for 1.5 sec 3 hrs after deorbit rehearsal TIG; on for 1.5 sec 4.5 hrs after deorbit rehearsal TIG STS-2 - Not used (contingency usage) OPS - Not used (contingency usage)
22250200 FU XFEED VLV 1-2 LA	73	7677	051	STS-1 - Same as 22250100 STS-2 - Same as 22250100 OPS - Same as 22250100
22250300 OX XFEED VLV 3-5 LA	73	7677	051	STS-1 - Same as 22250100

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - Same as 22250100 OPS - Same as 22250100
22250400 FU XFEED VLV 3-5 LA	73	7677	051	STS-1 - Same as 22250100 STS-2 - Same as 22250100 OPS - Same as 22250100
22260 CROSSFEED VALVES - RIGHT AFT				FUNCTION: Provide for propellant transfer between aft RCS pods or feed OMS propellant to aft RCS engines. These are motor driven ball valves requiring only momentary power to open or close. The actuation time to either open or close the valves is 1.5 sec. USAGE: The normally closed valves are all opened by crew for RCS crossfeed operation or when OMS propellant is being fed to RCS engines. For RTLS aborts, the GPC automatically actuates valves open pre-dump and closes them post dump. ANALYSIS USAGE:
22260100 OX XFEED VLV 1-2 RA	73	7677	051	STS-1 - On for 1.5 sec 3 hrs after deorbit rehearsal TIG; on for 1.5 sec 4.5 hrs after deorbit rehearsal TIG STS-2 - Not used (contingency usage)

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Not used (contingency usage)
22260200 FU XFEED V 1-2 RA	73	7677	051	STS-1 - Same as 22260100
				STS-2 - Same as 22260100
				OPS - Same as 22260100
22260300 OX XFEED VLV 3-5 RA	73	7677	051	STS-1 - Same as 22260100
				STS-2 - Same as 22260100
				OPS - Same as 22260100
22260400 FU XFEED VLV 3-5 RA	73	7677	051	STS-1 - Same AS 22260100
				STS-2 - Same as 22260100
				OPS - Same as 22260100
22510 FORWARD RCS ENGINE HEATERS				FUNCTION: Maintain the injectors of the forward primary thrusters above 40 deg F. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station. (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress.

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Otherwise, duty cycles are a function of attitude and beta angle.
				ANALYSIS USAGE:
22510100 FWD RCS HT-ENG F1F-X	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510200 FWD RCS HT-ENG F1L+Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510300 FWD RCS HT-ENG F1U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510400 FWD RCS HT-ENG F1D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510500 FWD RCS HT-ENG F2F-X	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510600 FWD RCS HT-ENG F2R-Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510700 FWD RCS HT-ENG F2U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510800 FWD RCS HT-ENG F2D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22510900				

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FWD RCS HT-ENG F3F-X	22	7677	Asc, Des, 600 series	See appendix B heater tables
22511 FORWARD RCS ENGINE HEATERS				FUNCTION: See 22510. USAGE: See 22510. ANALYSIS USAGE:
22511100 FWD RCS HT-ENG F3L+Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22511200 FWD RCS HT-ENG F3U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22511300 FWD RCS HT-ENG F3D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22511400 FWD RCS HT-ENG F4R-Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22511500 FWD RCS HT-ENG F4D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520 AFT RCS ENG HTRS-RGT				FUNCTION: Maintain the injectors of the aft port primary thrusters above 40 deg F.

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Heaters are thermostatically controlled but may be enabled or disabled from the aft station. (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress. Otherwise, duty cycles are a function of attitude and beta angle.
				ANALYSIS USAGE:
22520100 AFT RCS HT-ENG R1R-Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520200 AFT RCS HT-ENG R2R-Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520300 AFT RCS HT-ENG R3R-Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520400 AFT RCS HT-ENG R4R-Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520500 AFT RCS HT-ENG R2D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520600 AFT RCS HT-ENG R3D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520700 AFT RCS HT-ENG R4D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22520800 AFT RCS HT-ENG R1U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22520900 AFT RCS HT-ENG R2U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22521 AFT RCS ENG HTRS-RGT				FUNCTION: See 22520. USAGE: See 22520. ANALYSIS USAGE:
22521100 AFT RCS HT-ENG R4U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22521200 AFT RCS HT-ENG R1A+X	32	7677	Asc, Des, 600 series	See appendix B heater tables
22521300 AFT RCS HT-ENG R3A+X	32	7677	Asc, Des, 600 series	See appendix B heater tables
22530 AFT RCS ENG HTRS-LFT				FUNCTION: Maintain the injectors of the aft starboard primary thrusters above 40 deg F. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station. (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress. Other-

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				wise, duty cycles are a function of attitude and beta angle.
				ANALYSIS USAGE:
22530100 AFT RCS HT-ENG L1L+Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530200 AFT RCS HT-ENG L2L+Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530300 AFT RCS HT-ENG L3L+Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530400 AFT RCS HT-ENG L4L+Y	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530500 AFT RCS HT-ENG L2D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530600 AFT RCS HT-ENG L3D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530700 AFT RCS HT-ENG L4D-Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22530800 AFT RCS HT-ENG L1U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22530900 AFT RCS HT-ENG L2U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22531 AFT RCS ENG HTRS-LFT				FUNCTION: See 22530. USAGE: See 22530. ANALYSIS USAGE:
22531100 AFT RCS HT-ENG L4U+Z	22	7677	Asc, Des, 600 series	See appendix B heater tables
22531200 AFT RCS HT-ENG L1A+X	32	7677	Asc, Des, 600 series	See appendix B heater tables
22531300 AFT RCS HT-ENG L3A+X	32	7677	Asc, Des, 600 series	See appendix B heater tables
22540 FORWARD VERNIER ENGINE HEATERS				FUNCTION: Maintain the injectors of the forward vernier thrusters above 40 deg F. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress. Otherwise, duty cycles are a function of attitude and beta angle.

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
22540100 FWD VRN HT-ENG F5R	11	7677	Asc, Des, 600 series	See appendix B heater tables
22540200 FWD VRN HT-ENG F5L	11	7677	Asc, Des, 600 series	See appendix B heater tables
22550 AFT VERNIER ENGINE HEATERS				FUNCTION: Maintain the injectors of the aft vernier thrusters above 40 deg F. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress. Otherwise, duty cycles are a function of attitude and beta angle.
				ANALYSIS USAGE:
22550100 AFT VRN HT-ENG R5D-Z	11	7677	Asc, Des, 600 series	See appendix B heater tables
22550200 AFT VRN HT-ENG R5R-Y	11	7677	Asc, Des, 600 series	See appendix B heater tables
22550300 AFT VRN HT-ENG L5D-Z	11	7677	Asc, Des, 600 series	See appendix B heater tables

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22550400 AFT VRN HT-ENG L5L+Y	11	7677	Asc, Des, 600 series	See appendix B heater tables
22560 FUEL PANEL HEATERS				FUNCTION: Maintain the fwd module temperatures above 40° F. The A and B heaters are redundant. However, only system A or system B may be enabled at one time, but both may be disabled. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress. Otherwise, duty cycles are a function of attitude and beta angle. ANALYSIS USAGE:
22560100 FUEL UP PAN 1 HTR A	97	7677	Asc, 600 series	See appendix B heater tables
22560210 FUEL UP PAN 1 HTR B	97	7677	Asc, 600 series	See appendix B heater tables
22560300 FUEL FWD PAN 3 HTR A	108	7677	Asc, 600 series	See appendix B heater tables
22560410 FUEL FWD PAN 3 HTR B	108	7677	Asc, 600 series	See appendix B heater tables

TABLE A-XII.- REACTION CONTROL SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22560500 FUEL LOW PAN 5 HTR A	97	7677	Asc, 600 series	See appendix B heater tables
22560610 FUEL LOW PAN 5 HTR B	97	7677	Asc, 600 series	See appendix B heater tables
22570 OXID PANEL HEATERS				FUNCTION: Maintain the fwd module temperatures above 40° F. The A and B heaters are redundant. However, only system A or system B may be enabled at one time, but both may be disabled. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A14). Once disabled for the Ascent or Descent phases they cannot be enabled until after seat egress. Otherwise, duty cycles are a function of attitude and beta angle. ANALYSIS USAGE:
22570100 OXID UP PAN 2 HTR A	97	7677	Asc, 600 series	See appendix B heater tables
22570210 OXID UP PAN 2 HTR B	97	7677	Asc, 600 series	See appendix B heater tables
22570300 OXID FWD PAN 4 HTR A	108	7677	Asc, 600 series	See appendix B heater tables

TABLE A-XII.- REACTION CONTROL SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
22570410 OXID FWD PAN 4 HTR B	108	7677	Asc, 600 series	See appendix B heater tables
22570500 OXID LOW PAN 6 HTR A	97	7677	Asc, 600 series	See appendix B heater tables
22570610 OXID LOW PAN 6 HTR B	97	7677	Asc, 600 series	See appendix B heater tables

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
30020 FCP 02 FLOWMETERS				FUNCTION: Provide dc instrumentation power for oxygen flowmeters. USAGE: On continuously when associated FCP is on, off when FCP is shutdown; manually controlled by switch or circuit breaker. ANALYSIS USAGE:
30020100 FCP #1 02 FLOWMETER	5	7677	101	On from pwr xfr int to EOM
30020200 FCP #2 02 FLOWMETER	5	7677	101	On from pwr xfr int to EOM
30020300 FCP #3 02 FLOWMETER	5	7677	101	On from pwr xfr int to EOM
30030 FCP H2 FLOWMETERS				FUNCTION: Provide dc instrumentation power for hydrogen flowmeters. USAGE: On continuously when associated FCP is on, off when FCP is shutdown; manually controlled by switch or circuit breaker. ANALYSIS USAGE:
30030100 FCP #1 H2 FLOWMETER	5	7677	101	On from pwr xfr int to EOM

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
30030200 FCP #2 H2 FLOWMETER	5	7677	101	On from pwr xfr int to EOM
30030300 FCP #3 H2 FLOWMETER	5	7677	101	On from pwr xfr int to EOM
30040 FCP ELECT CONTROLS				FUNCTION: Fuel Cell Electronic Control Unit which controls fuel cell operation. The ground mode includes those heater relays utilized when the fuel cell is so lightly loaded that end-cell and sustaining heaters are activated. The Ground Start Up mode includes those and also the relays required to activate the start up heaters during initial activation. USAGE: Ground Start Up - On for fuel cell startup until the fuel cell achieves its operating temperature of 183-185 deg F (approx 15 min). Ground - On after the initial 15 min of fuel cell operation or when the fuel cell is lightly loaded. Orbit - On continuously when associated FCP is on (unless one of the other modes is on), off when FCP is shutdown; manually controlled by switch or circuit breaker. ANALYSIS USAGE:
30040100 FCP 1 EL CTL-GND S/U	20	7677	None	Not used (GSE usage)
30040110 FCP 1 EL CTL-GRND	15	7677	None	Not used (GSE usage)
30040120				

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FCP 1 EL CTL-ORBT	9	7677	101	On from pwr xfr int to EOM
30040200 FCP 2 EL CTL-GND S/U	19	7677	None	Not used (GSE usage)
30040210 FCP 2 EL CTL-GRND	14	7677	None	Not used (GSE usage)
30040220 FCP 2 EL CTL-ORBT	8	7677	101	On from pwr xfr int to EOM
30040300 FCP 3 EL CTL-GND S/U	19	7677	None	Not used (GSE usage)
30040310 FCP 3 EL CTL-GRND	15	7677	None	Not used (GSE usage)
30040320 FCP 3 EL CTL-ORBT	8	7677	101	On from pwr xfr int to EOM
30050 FCP PUMP & H2O SENSORS				FUNCTION: Two pumps are used, one circulates hydrogen reactant and simultaneously separates water; the other circulates coolant through the heat exchanger. The H2O Sensor monitors water purity (pH) for potability and provides an event warning to the crew if not potable. USAGE: On continuously when associated FCP is on; off when FCP is shutdown. ANALYSIS USAGE:
30050100				

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FCP1 PMP&H2O SENSOR	179	7677	101	On from pwr xfr int to EOM
30050200 FCP2 PMP&H2O SENSOR	176	7677	101	On from pwr xfr int to EOM
30050300 FCP3 PMP&H2O SENSOR	178	7677	101	On from pwr xfr int to EOM
30060 FCP 02 PRG/DUAL FDV'S				FUNCTION: Three way valves which control 02 flow to the FCP's for power generation and purging. Normally in operate position, energized to purge position. USAGE: Energized for the duration of each fuel cell purge (2 min/FCP). FCP design assumes one 2-min purge/8 hrs. A fuel cell purge cannot be performed at power levels above 10 kw without exceeding regulator low temp limits because of the high cryogenic flow rate involved. ANALYSIS USAGE:
30060100 FCP1 02 PRG/DUAL FDV	10	7677	431	On for 2 min beginning at start of each fuel cell purge
30060200 FCP2 02 PRG/DUAL FDV	10	7677	431	On for 2 min beginning 2 min after the start of each fuel cell purge
30060300 FCP3 02 PRG/DUAL FDV	10	7677	431	On for 2 min beginning 4 min after the start of each fuel cell purge

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
30070 FCP GH2 PURGE VALVES				FUNCTION: Control hydrogen reactant purging of fuel cells. USAGE: Energized for the duration of each fuel cell purge (2 min/FCP). FCP design assumes one 2-min purge/8 hrs. A fuel cell purge cannot be performed at power levels above 10 kw without exceeding regulator low temp limits because of the high cryogenic flow rate involved. ANALYSIS USAGE:
30070100 FCP1 GH2 PURGE VALVE	10	7677	431	On for 2 min beginning at the start of each fuel cell purge
30070200 FCP2 GH2 PURGE VALVE	10	7677	431	On for 2 min beginning 2 min after the start of each fuel cell purge
30070300 FCP3 GH2 PURGE VALVE	10	7677	431	On for 2 min beginning 4 min after the start of each fuel cell purge
30510 GO2 PURGE LINE HTRS				FUNCTION: Operate during fuel cell purges to prevent condensate from freezing in the vent lines. USAGE: One on from 16 min prior to each FCP purge, through the 6 min purge (2 min/FCP), until 55 min post purge.

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				(Heaters are redundant and selectable.)
				ANALYSIS USAGE:
30510100 GO2 PRG LNE HTR AUT	41	7677	431	On for 1 hr 17 min beginning 16 min prior to each fuel cell purge
30510210 GO2 PRG LNE HTR MAN	41	7677	None	Not used (redundant power)
30520 GH2 PURGE LINE HTRS				FUNCTION:
				Operate during fuel cell purges to prevent condensate from freezing in the vent lines.
				USAGE:
				One on from 16 min prior to each FCP purge, through the 6 min purge (2 min/FCP), until 55 min post purge. (Heaters are redundant and selectable.)
				ANALYSIS USAGE:
30520100 GH2 PRG LNE HTR AUT	52	7677	431	On for 1 hr 17 min beginning 16 min prior to each fuel cell purge
30520210 GH2 PRG LNE HTR MAN	52	7677	None	Not used (redundant power)
30530 H2O VENT LINE HTRS				FUNCTION:
				Prevent water from freezing in the lines between the water relief valves and the water relief vent nozzle, should relief valve operation occur.
				USAGE:

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Heaters are thermostatically controlled. They are enabled or disabled from the aft station (Pnl R12A1). For most missions they will be disabled prelaunch and enabled after OMS-2 and seat egress. Systems A and B are redundant.
				ANALYSIS USAGE:
30530100 H2O VENT LN HTR A	9	7677	Des, 600 series	See appendix B heater tables
30530210 H2O VENT LN HTR B	9	7677	None	Not used (redundant power)
30540 FCP H2O RELF VL HTRS				FUNCTION:
				Prevent water from freezing in the FCP water relief valves.
				USAGE:
				Heaters are thermostatically controlled. They are enabled or disabled from the aft station (Pnl R12A1). For most missions they will be disabled prelaunch and enabled after OMS-2 and seat egress. Systems A and B are redundant.
				ANALYSIS USAGE:
30540100 FCP1 H2O RLF VL HT A	3	7677	Des, 600 series	See appendix B heater tables
30540210 FCP1 H2O RLF VL HT B	3	7677	None	Not used (redundant power)
30540300				

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FCP2 H2O RLF VL HT A	3	7677	Des, 600 series	See appendix B heater tables
30540410 FCP2 H2O RLF VL HT B	3	7677	None	Not used (redundant power)
30540500 FCP3 H2O RLF VL HT A	3	7677	Des, 600 series	See appendix B heater tables
30540610 FCP3 H2O RLF VL HT B	3	7677	None	Not used (redundant power)
30560 H2O NOZZLE BARREL HEATERS				FUNCTION: Prevent water from freezing in the barrel of the water relief vent nozzle. USAGE: Heaters are not thermostatically controlled. They are activated from the same switch as the relief valve heaters (Ref. 30540) on Panel R12A1 at the aft station. Either A or B heater is on continuously when the corresponding A or B relief valve heater group is enabled. ANALYSIS USAGE:
30560100 H2O NOZ BARREL HTR A	6	7677	Asc,Des, 600 series	See appendix B heater tables
30560210 H2O NOZ BARREL HTR B	6	7677	None	Not used (redundant power)

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
30570 H2O NOZZLE ORIFICE HEATER				FUNCTION: Prevent water from freezing in the orifice of the water relief vent nozzle, should water relief valve operation occur. USAGE: The single heater is controlled by redundant electronic controllers which receive signals from temperature measurements located at the nozzle near the orifice. The controllers are activated from the same switch that enables the relief valve heaters (ref. 30540), on panel R12A1 at the aft station. Note: Water relief valve operation is not expected except during ascent when the acceleration head may exceed the relief setting of 47 psia. ANALYSIS USAGE: See appendix B heater tables
30570000 H2O NOZ ORIF HTR A/B	48	7677	Asc,Des, 600 series	
30590 FCP H2O LINE HTRS				FUNCTION: Operate to preclude water freezing in the lines between the FCP's and the water relief valve. USAGE: Not required during normal operation. Thermostatically controlled when the associated FCP is open circuit or shut down.

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
30590100 FCP1 H2O LINE HTR A	33	7677	None	Not used (contingency equipment)
30590210 FCP1 H2O LINE HTR B	33	7677	None	Not used (contingency equipment)
30590300 FCP2 H2O LINE HTR A	22	7677	None	Not used (contingency equipment)
30590410 FCP2 H2O LINE HTR B	22	7677	None	Not used (contingency equipment)
30590500 FCP3 H2O LINE HTR A	22	7677	None	Not used (contingency equipment)
30590610 FCP3 H2O LINE HTR B	22	7677	None	Not used (contingency equipment)
30600 FCP START HEATERS				FUNCTION: This component includes the Start Heaters and the Pump Control By-pass Valves. The Start Heaters are used to attain fuel cell operating temperature during activation. The Pump Control By-pass Valves operate to allow maximum flow during FCP startup. USAGE: Start Heaters are on for fuel cell startup, off when fuel cell achieves its operating temp of 183-185 deg F (approx. 15 min). The Pump Control By-pass Valves are normally closed; they are energized in during the FCP startup phase (approx. 15 min).

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: This component is a parasitic load, powered directly from the FCP, not from a vehicle bus.
				ANALYSIS USAGE:
30600100 FCP1 START HTR	3288	7677	None	Not used
30600200 FCP2 START HTR	3288	7677	None	Not used
30600300 FCP3 START HTR	3288	7677	None	Not used
30601 FCP SUSTAINING HTRS				FUNCTION:
				The Sustaining Heaters are used to attain fuel cell operating temperature during activation and also to maintain the operating temperature during low power consumption periods.
				USAGE:
				The Sustaining Heaters are on for fuel cell startup and at approximately 50% while the FCP is off-line. When the FCP is taken off-line, a 15 min cool down period is assumed before the Sustaining Heaters come on at a 50% usage factor. The Sustaining Heaters are on for the 15 min fuel cell activation period and then remain on at a 50% usage factor until the fuel cell is placed on-line.
				Note: This component is a parasitic load, powered directly from the FCP, not from a vehicle bus.
				ANALYSIS USAGE:
30601100				

TABLE A-XIII.- POWER GENERATION SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FCP1 SUSTAINING HTR	1133	7677	None	Not used
30601200 FCP2 SUSTAINING HTR	1132	7677	None	Not used
30601300 FCP3 SUSTAINING HTR	1133	7677	None	Not used
30610 FCP END CELL HTRS				FUNCTION: The End Cell Heaters maintain the end cells in the fuel cell reactor stack at temperatures consistent with the center of the stack. USAGE: End Cell Heaters are only required when the fuel cell is lightly loaded. On with a 50% usage factor beginning 15 min after a FCP is taken off-line, or 15 min after an FCP activation and ending when the FCP is turned off or reconnected to the load. Note: This component is a parasitic load, powered directly from the FCP, not from a vehicle bus. ANALYSIS USAGE:
30610100 FCP1 ACC ENDCELL HTR	161	7677	None	Not used
30610200 FCP2 ACC ENDCELL HTR	161	7677	None	Not used
30610300 FCP3 ACC ENDCELL HTR	161	7677	None	Not used
30610400				

TABLE A-XIII.- POWER GENERATION SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FCP1 PRB ENDCELL HTR	161	7677	None	Not used
30610500 FCP2 PRB ENDCELL HTR	161	7677	None	Not used
30610600 FCP3 PRB ENDCELL HTR	160	7677	None	Not used

A-XIV 3100
CRYOGENICS

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
31010 VAC-ION POWER SUPPLIES				FUNCTION: Power pumps that pull a vacuum between the inner and outer cryo tank shells to verify the integrity of the tank annulus. USAGE: On only during ground support activities (there are no cockpit controls). ANALYSIS USAGE:
31010100 02 #1 VAC-ION PWR SUP	3	7677	None	Not used (GSE power)
31010200 H2 #1 VAC-ION PWR SUP	3	7677	None	Not used (GSE power)
31010300 02 #2 VAC-ION PWR SUP	3	7677	None	Not used (GSE power)
31010400 H2 #2 VAC-ION PWR SUP	3	7677	None	Not used (GSE power)
31010500 02 #3 VAC-ION PWR SUP	3	7637	None	Not used (GSE power)
31010600 H2 #3 VAC-ION PWR SUP	3	7637	None	Not used (GSE power)
31030 TANK SIG COND QTY				FUNCTION: Monitor cryogenics tank quantity remaining, in percent. There is one unit per tank.

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				On continuously throughout all missions.
				ANALYSIS USAGE:
31030100 02 TNK1 SIG COND QTY	2	7677	101	On from pwr xfr int to EOM
31030200 H2 TNK1 SIG COND QTY	2	7677	101	Same as 31030100
31030300 02 TNK2 SIG COND QTY	2	7677	101	Same as 31030100
31030400 H2 TNK2 SIG COND QTY	3	7677	101	Same as 31030100
31030500 02 TNK3 SIG COND QTY	2	7637	101	STS-1 - N/A STS-2 - Same as 31030100 OPS - Same as 31030100
31030600 H2 TNK3 SIG COND QTY	2	7637	101	STS-1 - N/A STS-2 - Same as 31030100 OPS - Same as 31030100
31100 02 GSE SPLY VALVE				FUNCTION: Control flow of oxygen gas from GSE to fuel cells before launch to save cryogenics.

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Opened at approximately T-15 hours and closed at approximately T-10 minutes.
				ANALYSIS USAGE:
31100100 02 GSE SPLY VLV-CL	32	7677	None	Not used (GSE power)
31100210 02 GSE SPLY VLV-OP	37	7677	None	Same as 31100100 (GSE power)
31110 H2 GSE SPLY VALVE				FUNCTION:
				Control flow of hydrogen gas from GSE to fuel cells before launch to save cryogenic reactants.
				USAGE:
				Same as 31100
				ANALYSIS USAGE:
31110100 H2 GSE SPLY VLV-CL	32	7677	None	Same as 31100100 (GSE power)
31110210 H2 GSE SPLY VLV-OP	37	7677	None	Same as 31100100 (GSE power)
31120 FCP REACTANTS VALVES				FUNCTION:
				Control flow of reactants to the fuel cells. These are momentary operation, latching valves which require no holding current. Valves are normally open.
				USAGE:

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Normally open, actuated in contingency to shut down a fuel cell (momentary power). Approximate actuation time is 500 milliseconds.
				ANALYSIS USAGE:
31120100 FCP1 REAC VLV-OPEN	182	7677	None	Not used (contingency usage)
31120210 FCP1 REAC VLV-CLOSE	79	7677	None	Not used (contingency usage)
31120300 FCP2 REAC VLV-OPEN	182	7677	None	Not used (contingency usage)
31120410 FCP2 REAC VLV-CLOSE	79	7677	None	Not used (contingency usage)
31120500 FCP3 REAC VLV-OPEN	182	7677	None	Not used (contingency usage)
31120610 FCP3 REAC VLV-CLOSE	78	7677	None	Not used (contingency usage)
31130 ECLSS PRI 02 SUP-VLV				FUNCTION:
				Controls flow of 02 from the cryogenics system to the ECLSS. This is a latching solenoid valve, requiring momentary power to open or close.
				USAGE:
				Both this valve and 31140 are latched open throughout all missions (no power requirement).
				ANALYSIS USAGE:

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
31130100 ECLSS PRI 02 SUP-OPN	75	7677	None	Not used
31130210 ECLSS PRI 02 SUP-CLS	38	7677	None	Not used
31140 ECLSS SEC 02 SUP-VLV				FUNCTION: Same as 31130 (redundant) USAGE: Both this valve and 31130 are latched open throughout all missions (no power requirement). ANALYSIS USAGE:
31140100 ECLSS SEC 02 SUP-OPN	73	7677	None	Not used
31140210 ECLSS SEC 02 SUP-CLS	38	7677	None	Not used
31150 02 MANIFOLD VALVES				FUNCTION: Control flow of oxygen to the cryogenics manifolds. These are momentary operation, latching valves, which require no holding current. USAGE: Normally open, closed to isolate a leaking cryogenics tank or failed open relief valve from the manifolds (momentary power). Isolation of a tank results in the inability to operate one FCP.

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
31150100 02 MANIF VLV TK1-OPN	80	7677	None	Not used (contingency equipment)
31150210 02 MANIF VLV TK1-CLS	55	7677	None	Not used (contingency equipment)
31150300 02 MANIF VLV TK2-OPN	83	7677	None	Not used (contingency equipment)
31150410 02 MANIF VLV TK2-CLS	54	7677	None	Not used (contingency equipment)
31160 H2 MANIFOLD VALVES				FUNCTION: Control flow of hydrogen to the cryogenic manifolds. These are momentary operation, latching valves, which require no holding current. USAGE: Normally open, closed to isolate a leaking cryogenics tank or failed open relief valve from the manifolds (momentary power). Isolation of a tank results in the inability to operate one FCP.
				ANALYSIS USAGE:
31160100 H2 MANIF VLV TK1-OPN	120	7677	None	Not used (contingency equipment)
31160210 H2 MANIF VLV TK1-CLS	57	7677	None	Not used (contingency equipment)
31160300 H2 MANIF VLV TK2-OPN	120	7677	None	Not used (contingency equipment)

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
31160410 H2 MANIF VLV TK2-CLS	56	7677	None	Not used (contingency equipment)
31170 02 TANK HEATERS				

FUNCTION:

Maintain pressure in cryogenic oxygen tanks 1 and 2 between 811 and 846 psia, and in tanks 3 and 4 between 840 and 875 psia. When the pressure levels in both oxygen tanks 1 and 2 fall below 811 psia, or below 840 psia in both tanks 3 and 4, the respective enabled heaters are turned on. When the pressure level rises to 846 psia in either tank 1 or 2, or 875 psia in either tank 3 or 4, the enabled heaters for the respective tank sets are turned off. The heaters are cycled by the H202 Cryogenic Control Assemblies (see 06180).

Note: There is no capability to off-load cryogenics. Therefore, tanks will be full at the start of all missions.

USAGE:

Heaters in all tanks are disabled until approximately MECO + 5 min. The A heaters are then enabled and operate continuously until the tanks are pressurized to their respective upper limits, at which time cyclic operation begins. Later, the B heaters are enabled to operate with the A heaters. At approximately 50% oxygen remaining, the B heaters in each set will be disabled by the crew. This has no effect on total heater energy required. At approximately 10% oxygen remaining the A heaters are disabled. In general, the enabled heater duty cycles are a function of the average power level and oxygen quantity remaining.

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Note: Each heater cycle will correspond with a power level increase of the H202 Cryogenic Control Assembly. See 06180 and appendix B.
				ANALYSIS USAGE:
31170100 02 TANK1 HTR A1	211	7677	467	STS-1 - See appendix B-XIV STS-2 - See appendix B-XV OPS - See appendix B-XVI
31170200 02 TANK1 HTR A2	211	7677	467	See Analysis Usage for 31170100
31170300 02 TANK2 HTR A1	223	7677	469	See Analysis Usage for 31170100
31170400 02 TANK2 HTR A2	221	7677	469	See Analysis Usage for 31170100
31170500 02 TANK3 HTR A1	217	7637	483	STS-1 - N/A STS-2 - See appendix B-XV OPS - When 3 tank sets are used, the heater duty cycles will be as tabulated in appendix B-XV (same as STS-2). When 4 tank sets are used, tanks 3 and 4 will operate together with the same duty cycles as tanks 1 and 2, as tabulated in appendix B-XVI
31170600 02 TANK3 HTR A2	216	7637	483	See Analysis Usage for 31170500
31180 02 TANK HEATERS				FUNCTION:

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Maintain pressure in cryogenic oxygen tanks 1 and 2 between 811 and 846 psia, and in tanks 3 and 4 between 840 and 875 psia. When the pressure levels in both oxygen tanks 1 and 2 fall below 811 psia, or below 840 psia in both tanks 3 and 4, the respective enabled heaters are turned on. When the pressure level rises to 846 psia in either tank 1 or 2, or 875 psia in either tank 3 or 4, the enabled heaters for the respective tank sets are turned off. The heaters are cycled by the H202 Cryogenic Control Assemblies (see 06180). Note: There is no capability to off-load cryogenics. Therefore, tanks will be full at the start of all missions. USAGE: Heaters in all tanks are disabled until approximately MECO + 5 min. The A heaters are then enabled and operate continuously until the tanks are pressurized to their respective upper limits, at which time cyclic operation begins. Later, the B heaters are enabled to operate with the A heaters. At approximately 50% oxygen remaining, the B heaters in each set will be disabled by the crew. This has no effect on total heater energy required. At approximately 10% oxygen remaining the A heaters are disabled. In general, the enabled heater duty cycles are a function of the average power level and oxygen quantity remaining. Note: Each heater cycle will correspond with a power level increase of the H202 Cryogenic Control Assembly See 06180 and appendix B. ANALYSIS USAGE:

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
02 TANK1 HTR B1	212	7677	471	STS-1 - See appendix B-XIV STS-2 - See appendix B-XV OPS - See appendix B-XVI
31180200 02 TANK1 HTR B2	215	7677	471	See Analysis Usage for 31180100
31180300 02 TANK2 HTR B1	219	7677	473	See Analysis Usage for 31180100
31180400 02 TANK2 HTR B2	223	7677	473	See Analysis Usage for 31180100
31180500 02 TANK3 HTR B1	215	7637	485	STS-1 - N/A STS-2 - See appendix B-XV OPS - When 3 tank sets are used, the heater duty cycles will be as tabulated in appendix B-XV (same as STS-2). When 4 tank sets are used, tanks 3 and 4 will operate together with the same duty cycle as tanks 1 and 2, as tabulated in appendix B-XVI.
31180600 02 TANK3 HTR B2	220	7637	485	See Analysis Usage for 31180500
31190 H2 TANK HEATERS				FUNCTION: Maintain pressure in cryogenic hydrogen tanks 1 and 2 between 203 and 223 psia, and in tanks 3 and 4 between 220 and 240 psia. When the pressure levels in both hydrogen tanks 1 and 2 fall below 203 psia, or below 220 psia in both tanks 3 and 4, the respective enabled

TABLE A-XIV.- CRYOGENICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				heaters are turned on. When the pressure level rises to 223 psia in either tank 1 or 2, or 240 psia in either tank 3 or 4, the enabled heaters for the respective tank sets are turned off. The heaters are cycled by the H202 Cryogenic Control Assemblies (see 06180).
				Note: There is no capability to off-load cryogenics. Therefore, tanks will be full at the start of all missions.
				USAGE:
				Heaters in all tanks are disabled until approximately MECO + 5 min. The A heaters are then enabled and operate continuously until the tanks are pressurized to their respective upper limits, at which time cyclic operation begins. Later, the B heaters are enabled to operate with the A heaters. At approximately 50% hydrogen remaining, the B heaters in each set will be disabled by the crew. This has no effect on total heater energy required. At approximately 10% hydrogen remaining the A heaters are disabled. In general, the enabled heater duty cycles are a function of the average power level and hydrogen quantity remaining.
				Note: Each heater cycle will correspond with a power level increase of the H202 Cryogenic Control Assemblies (see 06180).
				ANALYSIS USAGE:
31190100 H2 TANK1 HTR A	96	7677	475	STS-1 - See appendix B-XIV
				STS-2 - See appendix B-XV
				OPS - See appendix BXVI

TABLE A-XIV.- CRYOGENICS SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
31190200 H2 TANK1 HTR B	97	7677	479	See Analysis Usage for 31190100
31190300 H2 TANK2 HTR A	99	7677	477	See Analysis Usage for 31190100
31190400 H2 TANK2 HTR B	99	7677	481	See Analysis Usage for 31190100
31190500 H2 TANK3 HTR A	97	7637	487	STS-1 - N/A STS-2 - See appendix B-XV OPS - When 3 tank sets are used, the heater duty cycles will be as tabulated in appendix B-XV (same as STS-2). When 4 tank sets are used, tanks 3 and 4 will operate together with the same duty cycles as tanks 1 and 2, as tabulated in appendix B-XVI
31190600 H2 TANK3 HTR B	98	7637	489	See Analysis Usage for 31190500

A-XV 3200
APU

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32020 APU FUEL ISOLATION VALVES				FUNCTION: Isolate the APU fuel tanks from the fuel pumps when closed. These are normally closed valves, powered open. USAGE: Energized (open) during APU operation. ANALYSIS USAGE:
32020100 APU 1 FU ISO VLV#1	33	7677	207,463,507	OFT - Energized from 5 min prior to lift-off until 5 min 20 sec after MECO, for 4 min 30 sec beginning at the start of the onorbit FCS checkout, and from 3 min prior to deorbit until 2 min after stoproll OPS - Energized from 5 min prior to lift-off until 5 min 20 sec after MECO, for 4 min 30 sec beginning at the start of the onorbit FCS checkout, and from 3 min prior to 400,000 ft until 2 min after stoproll
32020200 APU 1 FU ISO VLV#2	33	7677	207,463,507	OFT - Same as 32020100 OPS - Same as 32020100
32020300 APU 2 FU ISO VLV#1	33	7677	207,507	OFT - Energized from 5 min prior to lift-off until 5 min 20 sec after MECO, and from 3 min prior to deorbit until 2 min after stoproll OPS - Energized from 5 min prior to lift-off until 5 min 20 sec after MECO, and from 3 min prior to 400,000 ft until 2 min after stoproll

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32020400 APU 2 FU ISO VLV#2	33	7677	207,507	OFT - Same as 32020200 OPS - Same as 32020200
32020500 APU 3 FU ISO VLV#1	33	7677	207,507	OFT - Same as 32020200 OPS - Same as 32020200
32020600 APU 3 FU ISO VLV#2	33	7677	207,507	OFT - Same as 32020200 OPS - Same as 32020200
32030 APU CONTROLLERS				FUNCTION: Ground Test - Provides a means of testing controller operation via BITE. The active modes of the controller are checked by means of oscillator simulated turbine speeds. Operate - Provides monitoring and control of active APU's. In this mode, each controller will shut down it's associated APU in the event of turbine overspeed or underspeed. Heater Operation - Provides control of the Gas Generator/Fuel Pump Heater, which operates when the APU is off. USAGE: Ground Test - On only during ground support activities. Operate - On during APU operations.

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Heater Operation - On for approximately two hours prior to APU startup during prelaunch. Subsequently, on whenever the APU's are off.
				ANALYSIS USAGE:
32030100 APU 1 CNTLR-GRND TEST	33	7677	None	Not used (GSE power/usage)
32030110 APU 1 CNTLR - OPERATE	21	7677	207,463,507	OFT - On from 5 min prior to lift-off until 5 min 20 sec after MECO, for 4 min 30 sec beginning at the start of the onorbit FCS checkout, and from 3 min prior to deorbit until 2 min after stoproll OPS - On from 5 min prior to lift-off until 5 min 20 sec after MECO, for 4 min 30 sec beginning at the start of the onorbit FCS checkout, and from 3 min prior to 400,000 ft until 2 min after stoproll
32030120 APU 1 CNTLR-HTR OPRN	7	7677	051,105,107, 201,211,401, 433,501	OFT - On from pwr xfr int until 5 min prior to lift-off and from 3 min after insertion until 3 min prior to deorbit, except when the operate mode is on OPS - On from pwr xfr int until 5 min prior to lift-off and from 3 min after insertion until 3 min prior to descent to 400,000 ft, except when the operate mode is on
32030200 APU 2 CNTLR-GRND TEST	33	7677	None	Not used (GSE power/usage)
32030210 APU 2 CNTLR - OPERATE	21	7677	207,507	OFT - On from 5 min prior to lift-off until 5 min 20 sec after MECO, and from 3 min prior to deorbit until 2 min after stoproll

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On from 5 min prior to lift-off until 5 min 20 sec after MECO, and from 3 min prior to 400,000 ft until 2 min after stoproll
32030220 APU 2 CNTLR-HTR OPRN	7	7677	051,105,107, 201,211,401, 433,501	OFT - Same as 32030120 OPS - Same as 32030120
32030300 APU 3 CNTLR-GRND TEST	33	7677	None	Not used (GSE power/usage)
32030310 APU 3 CNTLR - OPERATE	21	7677	207,507	OFT - Same as 32030210 OPS - Same as 32030210
32030320 APU 3 CNTLR-HTR OPRN	7	7677	051,105,107 201,211,401, 433,501	OFT - Same as 32030120 OPS - Same as 32030120
32040 APU SHUTOFF VALVES				FUNCTION: Control the flow of hydrazine from the APU Fuel Pumps to the APU Gas Generator. They are a backup to the Fuel Iso Valves to isolate the Fuel Tanks from the catalytic beds. They also perform the function of the APU Modulating Valve in case that valve fails to close during APU operation. These are 3-way solenoid valves which are controlled by the APU Controller. When energized, they allow hydrazine flow between the APU Modulating Valves and the catalytic bed. When de-energized, they block flow to the Gas Generator and permit by-pass flow from the Fuel Pump outlet

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				to the inlet. USAGE: Energized (open) during APU operation. ANALYSIS USAGE:
32040100 APU 1 SHUTOFF VLV	37	7677	207,463,507	OFT - On from 5 min prior to lift-off until 5 min 20 sec after MECO, for 4 min 30 sec beginning at the start of the onorbit FCS checkout, and from 3 min prior to deorbit until 2 min after stoproll OPS - On from 5 min prior to lift-off until 5 min 20 sec after MECO, for 4 min 30 sec beginning at the start of onorbit FCS checkout, and from 3 min prior to 400,000 ft until 2 min after stoproll
32040200 APU 2 SHUTOFF VLV	37	7677	207,507	OFT - On from 5 min prior to lift-off until 5 min 20 sec after MECO, and from 3 min prior to deorbit until 2 min after stoproll OPS - On from 5 min prior to lift-off until 5 min 20 sec after MECO, and from 3 min prior to 400,000 ft until 2 min after stoproll
32040300 APU 3 SHUTOFF VLV	37	7677	207,507	OFT - Same as 32040200 OPS - Same as 32040200
32050 APU MODULATING VALVES				FUNCTION: Control the flow of hydrazine to the APU catalyst beds through the shutoff valves. These are 3-way

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				solenoid valves which are cycled by the APU Controller to control the speed of the APU Turbine. When energized, they stop hydrazine flow to the catalytic beds and permit by-pass flow from the Fuel Pump outlet to the inlet. When de-energized, they allow flow to the catalytic beds.
				USAGE:
				Cycle during APU operation with an approximate duty cycle of 50%.
				ANALYSIS USAGE:
32050100 APU 1 MODULATING VLV	37	7677	207,463,507	OFT - On at a 50% usage factor: from 5 min prior to lift-off until 5 min 20 sec after MECO; for 4 min 30 sec beginning at the start of the onorbit FCS checkout; and from 3 min prior to deorbit until 2 min after stoproll
				OPS - On at a 50% usage factor: from 5 min prior to lift-off until 5 min 20 sec after MECO; for 4 min 30 sec beginning at the start of the onorbit FCS checkout; and from 3 min prior to 400,000 ft until 2 min after stoproll
32050200 APU 2 MODULATING VLV	37	7677	207,507	OFT - On at a 50% usage factor: from 5 min prior to lift-off until 5 min 20 sec after MECO; and from 3 min prior to deorbit until 2 min after stoproll
				OPS - On at a 50% usage factor: from 5 min prior to lift-off until 5 min 20 sec after MECO; and from 3 min prior to 400,000 ft until 2 min after stoproll
32050300 APU 3 MODULATING VLV	37	7677	207,507	OFT - Same as 32050200

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - Same as 32050200
32060 APU GEAR BOX GN_2 VALVES				FUNCTION: Repressurizes the GN_2 accumulator in the APU gear box should GN_2 leakage occur. There is a single normally closed valve for each APU. USAGE: The valve is actuated open by the APU start/run switch provided that a pressure transducer, located in the accumulator, senses pressure below 5.5 psia. The valve is not expected to be used except in contingency leak cases. ANALYSIS USAGE:
32060100 APU 1 GR BOX GN_2 VLV	3	7677	None	Not used (contingency equipment)
32060200 APU 2 GR BOX GN_2 VLV	3	7677	None	Not used (contingency equipment)
32060300 APU 3 GR BOX GN_2 VLV	3	7677	None	Not used (contingency equipment)
32100 APU H2O SPRAY COOLING SYSTEM ISO VALVES				FUNCTION: Normally closed solenoid valves which provide isolation of the APU water spray tanks from the primary and secondary control valves (ref. 32110 and 32120). The secondary system will be utilized only in the event of a failure in the primary system.

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Energized manually after each APU shutdown onorbit.
				ANALYSIS USAGE:
32100100 PRI H20 TNK ISOL VLV	7	7677	105,211,465	On for 2 hrs 45 min starting at 1 min 30 sec after insertion and 4 min 30 sec after initiation of the onorbit FCS C/O
32100200 SEC H20 TNK ISOL VLV	7	7677	None	Not used (redundant equipment)
32110 H20 SPRAY COOLING SYS PRI CONTROL VALVES				FUNCTION:
				Normally closed solenoid valves which operate in a pulse mode during the period of APU water spray cooling system operation. The primary and secondary control valves are redundant. The secondary valves will operate only in the event of primary system failure.
				USAGE:
				Valves operate in a cyclic mode after each APU shutdown onorbit. The cycle time is approximately 1 sec on and 4 sec off.
				ANALYSIS USAGE:
32110100 APU 1 PRI H20 CNT VL	7	7677	105,211,465	On for 2 hrs 45 min with a 1.03% usage factor at the following times: 1 min 30 sec after insertion, and 4 min 30 sec after initiation of the onorbit FCS checkout

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
322110200 APU 2 PRI H20 CNT VL	7	7677	105,211	On for 2 hr 45 min with a 7.03% usage factor starting at 1 min 30 sec after insertion
32110300 APU 3 PRI H20 CNT VL	7	7677	105,211	Same as 32110200
32120 H20 SPRAY COOLING SYS SEC. CONTROL VALVES				FUNCTION: Same as 32110 USAGE: Valves operate in a cyclic mode in the event of a primary system failure. ANALYSIS USAGE:
32120100 APU 1 SEC H20 CNT VL	7	7677	None	Not used (redundant equipment)
32120200 APU 2 SEC H20 CNT VL	7	7677	None	Same as 32120100
32120300 APU 3 SEC H20 CNT VL	7	7677	None	Same as 32120100
32130 APU GG INJECTOR COOLING SYSTEM				FUNCTION: Cools APU gas generator injectors to a temperature where an APU restart can be safely made. USAGE: Used by the crew only when an emergency arises requiring a hot restart.

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
32130100 APU 1 GG H20 CNT VLV	7	7677	None	Not used (contingency usage)
32130200 APU 2 GG H20 CNT VLV	7	7677	None	Same as 32130100
32130300 APU 3 GG H20 CNT VLV	7	7677	None	Same as 32130100
32510 TANK HEATERS				FUNCTION:
				Prevent hydrazine from freezing. The heaters maintain the hydrazine temperature above 45 deg F. Systems A and B are redundant.
				USAGE:
				Heaters are thermostatically controlled. Either system A or system B is enabled/disabled from the aft station (PNL A-12). When enabled prelaunch some heaters may cycle during ascent, depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or B will be enabled prelaunch. The switches that control these heaters also control the feedline heaters (32520) and service line heaters (32530).
				ANALYSIS USAGE:
32510100 TK HTR 1A LH SIDE	63	7677	600 series	See appendix B heater tables
32510200 TK HTR 1B LH SIDE	63	7677	None	Not used (redundant equipment)

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32510300 TK HTR 2A LH SIDE	63	7677	600 series	See appendix B heater tables
32510400 TK HTR 2B LH SIDE	63	7677	None	Not used (redundant equipment)
32510500 TK HTR 3A RH SIDE	63	7677	600 series	See appendix B heater tables
32510600 TK HTR 3B RH SIDE	63	7677	None	Not used (redundant equipment)
32520 FUEL FEEDLINE HEATERS				FUNCTION: Maintain lines between the APU Fuel Isolation Valves and the Fuel Pumps above 45 deg F to prevent freezing. Systems A and B are redundant. USAGE: Heaters are thermostatically controlled. Either system A or system B is enabled/disabled from the aft station (PNL A-12). When enabled prelaunch, some heaters may cycle during ascent, depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or B will be enabled prelaunch. The switches that control these heaters also control the APU tank heaters (32510) and service line heaters (32530). ANALYSIS USAGE:
32520100 FUEL FEEDLINE HTR 1A	68	7677	Asc,Des, 600 series	See appendix B heater tables

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32520200 FUEL FEEDLINE HTR 1B	68	7677	None	Not used (redundant equipment)
32520300 FUEL FEEDLINE HTR 2A	81	7677	Asc,Des, 600 series	See appendix B heater tables
32520400 FUEL FEEDLINE HTR 2B	81	7677	None	Not used (redundant equipment)
32520500 FUEL FEEDLINE HTR 3A	48	7677	Asc,Des, 600 series	See appendix B heater tables
32520600 FUEL FEEDLINE HTR 3B	48	7677	None	Not used (redundant equipment)
32530 FUEL SERVICE LINE HEATERS				

FUNCTION:

Maintain the fuel fill lines above 45 deg F to prevent freezing. Systems A and B are redundant.

USAGE:

Heaters are thermostatically controlled. Either system A or system B is enabled/disabled from the aft station (PNL A-12). When enabled prelaunch, some heaters may cycle during ascent depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or B will be enabled prelaunch. The switches that control these heaters also control the APU tank heaters (32510) and the fuel feedline heaters (32520).

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
32530100 FUEL SERVLINE HTR 1A	64	7677	Asc,Des, 600,series	See appendix B heater tables
32530200 FUEL SERVLINE HTR 1B	64	7677	None	Not used (redundant equipment)
32530300 FUEL SERVLINE HTR 2A	48	7677	Asc,Des, 600 series	See appendix B heater tables
32530400 FUEL SERVLINE HTR 2B	48	7677	None	Not used (redundant equipment)
32530500 FUEL SERVLINE HTR 3A	64	7677	Asc,Des, 600 series	See appendix B heater tables
32530600 FUEL SERVLINE HTR 3B	64	7677	None	Not used (redundant equipment)
32540 FUEL DRAIN LINE HEATERS				FUNCTION: Maintain the fuel drain lines above 45 deg F to prevent freezing. Systems A and B are redundant. The Drain Line Heaters are controlled by the Service Line Heater Thermostats. USAGE: Heaters are thermostatically controlled. Either system A or system B is enabled/disabled from the aft station (PNL A-12). When enabled prelaunch,

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				some heaters may cycle during ascent, depending upon prelaunch purge temperatures. Otherwise, duty cycles are a function of attitude and beta angle. For most missions, either system A or B will be enabled prelaunch.
				ANALYSIS USAGE:
32540100 FUEL DRN LINE HTR 1A	41	7677	Asc, Des, 600 series	See appendix B heater tables
32540200 FUEL DRN LINE HTR 1B	41	7677	None	Not used (redundant equipment)
32540300 FUEL DRN LINE HTR 2A	53	7677	Asc,Des, 600 series	See appendix B heater tables
32540400 FUEL DRN LINE HTR 2B	53	7677	None	Not used (redundant equipment)
32540500 FUEL DRN LINE HTR 3A	33	7677	Asc,Des, 600 series	See appendix B heater tables
32540600 FUEL DRN LINE HTR 3B	33	7677	None	Not used (redundant equipment)
32550 FUEL PUMP/LINE HTRS				FUNCTION:
				Control temperature of the APU fuel pumps and connecting lines. They maintain the pumps between 60 deg F and 90 deg F. Systems A and B are redundant.
				USAGE:

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				System A or B enabled continuously. Thermostatically controlled when the APU's are off; both disabled when the APU's are on. Duty cycle is a function of attitude and beta angle. It is estimated that one set of heaters will be on during prelaunch until APU startup.
				ANALYSIS USAGE:
32550100 FUEL PMP/LINE HTR 1A	57	7677	Asc, 600 series	See appendix B heater tables
32550210 FUEL PMP/LINE HTR 1B	57	7677	None	Not used (redundant equipment)
32550300 FUEL PMP/LINE HTR 2A	57	7677	Asc, 600 series	See appendix B heater tables
32550410 FUEL PMP/LINE HTR 2B	57	7677	None	Not used (redundant equipment)
32550500 FUEL PMP/LINE HTR 3A	57	7677	Asc, 600 series	See appendix B heater tables
32550610 FUEL PMP/LINE HTR 3B	57	7677	None	Not used (redundant equipment)
32560 TURBINE GAS GENERATOR HEATERS				FUNCTION:
				Control the temperatures of the APU catalytic beds, the two control valves, and the gearboxes. The temperatures are controlled via the APU controllers, by means of temperature probes in the catalytic beds

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				and thermal switches on the gearboxes. The controllers maintain the catalytic beds between 360 deg F and 490 deg F and the gearboxes between 45 deg F and 70 deg F. Systems A and B are redundant. USAGE: System A or B is enabled continuously. Each heater is thermostatically controlled when its respective APU is off and is disabled when that APU is on. When enabled, either control sensing "low" temp will turn the heater on. Duty cycle is a function of attitude and beta angle. It is estimated that one heater set will be on during prelaunch until APU startup. ANALYSIS USAGE:
32560100 TURB GAS GEN HTR 1A	57	7677	Asc, 600 series	See appendix B heater tables
32560210 TURB GAS GEN HTR 1B	57	7677	None	Not used (redundant equipment)
32560300 TURB GAS GEN HTR 2A	57	7677	Asc, 600 series	See appendix B heater tables
32560410 TURB GAS GEN HTR 2B	57	7677	None	Not used (redundant equipment)
32560500 TURB GAS GEN HTR 3A	57	7677	Asc, 600 series	See appendix B heater tables
32560610 TURB GAS GEN HTR 3B	57	7677	None	Not used (redundant equipment)

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32570 OIL LINE HEATERS				FUNCTION: Maintain APU gearbox lube oil lines above 45 deg F. Systems A and B are redundant. USAGE: System A or B enabled continuously. Thermostatically controlled; duty cycle is a function of attitude and beta angle. It is estimated that one heater set will be on during prelaunch until APU startup. ANALYSIS USAGE:
32570100 OIL LINE HTR 1A	69	7677	Asc, 600 series	See appendix B heater tables
32570210 OIL LINE HTR 1B	69	7677	None	Not used (redundant equipment)
32570300 OIL LINE HTR 2A	71	7677	Asc, 600 series	See appendix B heater tables
32570410 OIL LINE HTR 2B	71	7677	None	Not used (redundant equipment)
32570500 OIL LINE HTR 3A	71	7677	Asc, 600 series	See appendix B heater tables
32570610 OIL LINE HTR 3B	71	7677	None	Not used (redundant equipment)
32580				

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
APU H20 SPRAY COOL SYS LINE HEATERS - PRI				FUNCTION: Provides a controlled environment for the H20 lines of the primary APU H20 spray cooling system. The heaters in the primary system are redundant. USAGE: The primary system heaters are enabled during ascent, onorbit, and descent phases. ANALYSIS USAGE:
32580100 APU 1 PRI H20 HTR 1A	28	7677	Asc,Des, 600 series	See appendix B heater tables
32580200 APU 1 PRI H20 HTR 1B	28	7677	Asc,Des, 600 series	See appendix B heater tables
32580300 APU 2 PRI H20 HTR 1A	8	7677	Asc,Des, 600 series	See appendix B heater tables
32580400 APU 2 PRI H20 HTR 1B	8	7677	Asc,Des, 600 series	See appendix B heater tables
32580500 APU 3 PRI H20 HTR 1A	27	7677	Asc,Des, 600 series	See appendix B heater tables
32580600 APU 3 PRI H20 HTR 1B	27	7677	Asc,Des, 600 series	See appendix B heater tables

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32590 APU H20 SPRAY COOL SYS LINE HEATERS-SEC				FUNCTION: Provides a controlled environment for the H20 lines of the secondary APU H20 spray cooling system. The heaters in the secondary system are redundant. USAGE: The secondary system heaters are enabled during ascent, onorbit, and descent phases. ANALYSIS USAGE:
32590100 APU 1 SEC H20 HTR 2A	30	7677	Asc,Des, 600 series	See appendix B heater tables
32590200 APU 1 SEC H20 HTR 2B	30	7677	Asc,Des, 600 series	See appendix B heater tables
32590300 APU 2 SEC H20 HTR 2A	14	7677	Asc,Des, 600 series	See appendix B heater tables
32590400 APU 2 SEC H20 HTR 2B	14	7677	Asc,Des, 600 series	See appendix B heater tables
32590500 APU 3 SEC H20 HTR 2A	14	7677	Asc,Des, 600 series	See appendix B heater tables
32590600 APU 3 SEC H20 HTR 2B	14	7677	Asc,Des, 600 series	See appendix B heater tables

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32600 APU PRI SYS H20 TANK HEATERS				FUNCTION: Provide a controlled environment for the APU primary H20 spray system H20 tank. The tank heaters are redundant. USAGE: The primary system heaters are enabled during ascent, onorbit, and descent phases. ANALYSIS USAGE:
32600100 PRI H20 TNK PRI HTR	15	7677	Asc,Des, 600 series	See appendix B heater tables
32600200 PRI H20 TNK SEC HTR	15	7677	Asc,Des, 600 series	See appendix B heater tables
32610 APU SEC SYS H20 TANK HEATERS				FUNCTION: Provide a controlled environment for the APU secondary H20 spray system H20 tank. The tank heaters are redundant. USAGE: The secondary system heaters are enabled during ascent, onorbit, and descent phases. ANALYSIS USAGE:

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
32610100 SEC H20 TNK PRI HTR	15	7677	Asc,Des, 600 series	See appendix B heater tables
32610200 SEC H20 TNK SEC HTR	15	7677	Asc,Des, 600 series	See appendix B heater tables
32620 APU GG H20 TANK HEATERS				FUNCTION: Provide a controlled environment for the APU GG injector cooling system tank. The tank heaters are redundant. USAGE: The APU GG H20 tank heaters are enabled during ascent, onorbit, and descent phases. Duty cycles are primarily a function of attitude. ANALYSIS USAGE:
32620100 GG H20 TNK PRI HTR	12	7677	Asc,Des, 600 series	See appendix B heater tables
32620200 GG H20 TNK SEC HTR	12	7677	Asc,Des, 600 series	See appendix B heater tables
32630 APU GG H20 TANK LINE HEATERS				FUNCTION: Provide a controlled environment for the lines between the GG H20 tank and injector. The heaters

TABLE A-XV.- AUXILIARY POWER UNIT SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				are redundant. USAGE: Heaters are enabled during ascent, descent, and onorbit phases. Duty cycles are primarily a function of attitude. ANALYSIS USAGE:
32630100 GG H20 TK LN HT S04A	12	7677	Asc,Des, 600 series	See appendix B heater tables
32630200 GG H20 TK LN HT S04B	12	7677	Asc,Des, 600 series	See appendix B heater tables
32630300 GG H20 TK LN HT S03A	23	7677	Asc,Des, 600 series	See appendix B heater tables
32630400 GG H20 TK LN HT S03B	23	7677	Asc,Des, 600 series	See appendix B heater tables

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TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40010 CABIN FANS				FUNCTION: Circulate cabin air through the flight deck for air temperature and humidity control. The fans provide cooling for the crew and for air ccoled avionics on the flight deck. The fans are redundant. USAGE: One on continuously throughout all missions. ANALYSIS USAGE:
40010100 CABIN FAN A	494	7677	101	On from pwr xfr int to EOM
40010210 CABIN FAN B	478	7677	None	Not used (redundant equipment)
40011 VACUUM CLEANER				FUNCTION: General housekeeping activities such as cleaning fan filters, air intake holes on flight deck, etc., or for contingency cleanup. USAGE: Cleaning cabin air fan filters, grids and IMU air intake filters. Note: This is a single component but may be used on either AC1 or AC3 utility outlets on the flight or mid deck. ANALYSIS USAGE:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40011100 VACUUM CLEANER - AC1	450	7677	None	Not used
40011200 VACUUM CLEANER - AC3	450	7677	None	Not used
40020 CABIN AIR TEMP CONTROLLERS				FUNCTION: Position the valve which controls the flow of cabin air bypassing the cabin heat exchanger. The active actuator operates under control of the cabin air temp controller electronics (see 40030). The valve actuators require power only when moving and the valve can be manually positioned in the event of a controller failure. USAGE: One control valve actuator is active throughout all missions. The duty cycle is TBD. Note: It is estimated that once a stable cabin temperature is attained, the duty cycle of the active valve actuator will be relatively small.
40020100 CAB AIR TEMP CNT-PRI	17	7677	101	ANALYSIS USAGE: On with a 20% usage factor from pwr xfr int to EOM
40020210 CAB AIR TEMP CNT-SEC	17	7677	None	Not used (redundant equipment)
40030 CABIN AIR TEMP CNTL ELECT				FUNCTION:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Each controller controls the position of its corresponding cabin air temp control valve actuator so as to maintain the selected cabin air temperature (see 40020). In addition, the controllers provide signal conditioning for the primary and secondary instrumentation in the cabin air system.
				USAGE:
				One controller is on continuously throughout all missions
				ANALYSIS USAGE:
40030100 CAB AIR TMP CN EL-PR	4	7677	101	On from pwr xfr int to EOM
40030200 CAB AIR TMP CN EL-SC	4	7677	None	Not used (redundant equipment)
40040 CABIN AIR SIGNAL CND				FUNCTION:
				Provides power and signal conditioning for the cabin humidity sensor, the CO2 sensor, and the fan differential pressure measurement.
				USAGE:
				On continuously throughout all missions.
				ANALYSIS USAGE:
40040000 CAB AIR SIGNAL COND	4	7677	101	On from pwr xfr int to EOM
40050 ARS HUMIDITY SEP				FUNCTION:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Withdraw water from the cabin air heat exchanger, separate water and gas, and pump the water to the waste water tank. The units are redundant.
				USAGE:
				One unit is on continuously throughout all missions.
				ANALYSIS USAGE:
40050100 ARS HUMIDITY SEP A	29	7677	None	Not used (redundant equipment)
40050210 ARS HUMIDITY SEP B	28	7677	101	On from pwr xfr int to EOM
40060 ARS HUM SEP SIG CND				FUNCTION:
				Provides signal conditioning for the humidity separator speed instrumentation.
				USAGE:
				On continuously throughout all missions.
				ANALYSIS USAGE:
40060000 ARS HUM SEP SIG CND	2	7677	101	On from pwr xfr int to EOM
40070 PP02 CONTROLLERS				FUNCTION:
				The oxygen partial pressure controllers receive signals from the PP02 sensors (40076) proportional to the partial pressure of oxygen in the cabin. The controllers output control signals to the 02 control valves (40071) to maintain the oxygen partial pressure at 3.2 $\pm$ 0.25

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				psi. USAGE: Both are required on during ascent and descent. On-orbit at least one is required on, the unused controller may be powered off. This will however result in powering off the associated 02 and N2 Flow Sensors (40075) and for System 1 the single Cabin Pressure Sensor (40073200) with resulting loss of these sensors to the C&W system. ANALYSIS USAGE:
40070100 PP02 CNTLR-SYS 1	1	7677	None	Not used (low power)
40070200 PP02 CNTLR-SYS 2	1	7677	None	Not used (low power)
40071 02 CONTROL VLVS				FUNCTION: Control, in response to signals from the PP02 Controllers (40070), whether oxygen or nitrogen flows to the cabin regulator or emergency (8 psi) regulator. The valves are normally closed solenoid valves drawing power only when commanded open by the associated PP02 controller. When open the valve permits nitrogen flow; when closed, oxygen flow. USAGE: For normal on-orbit operation one control valve will be operating continuously with an approximate duty cycle of 50%. During critical periods (ascent and descent) and periods when a high flow rate is anticipated (8 psi contingency and airlock repress) both

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				will be enabled and operating with an approximate duty cycle of 50%.
				ANALYSIS USAGE:
40071100 02 CONTROL VLV-SYS 1	9	7677	101	On with a 50% usage factor from pwr xfr int to EOM
40071200 02 CONTROL VLV-SYS 2	9	7677	051,109,123, 419,433,457	STS-1 - On with a 50% usage factor from pwr xfr int to PLB door open initiation, from 3 hrs 15 min prior to until 30 min after the rehearsal deorbit, and from 3 hrs 15 min prior to deorbit until EOM STS-2 - On with a 50% usage factor from power xfr int to PLB door open initiation, and from 3 hrs 15 min prior to deorbit until EOM OPS - On with a 50% usage factor from pwr xfr int to PLB door open initiation, from 3 hrs 15 min prior to deorbit until EOM, and for 10 min immediately following all EVA's
40072 02 SELECTOR VALVES				FUNCTION: Provide 02 from the primary or secondary cryogenic supply to the emergency breathing subsystem and to the prebreathe and PLSS recharge functions in the airlock. Also permit auxiliary oxygen flow to the normal 02 Regulators. These are normally closed solenoid valves which draw power only when open. USAGE: One on (open) for 3 hours pre-EVA for crew prebreathe, one on for 30 min post EVA for PLSS recharge. One may be on during the 96 hr contingency, both on during

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				the 8 psi cabin contingency.
				'ANALYSIS USAGE:
40072100 02 SELECTR VLV-SYS 1	11	7677	417,419	On from 3 hrs pre-EVA until EVA initiation, on for 30 min beginning 1 hr post EVA
40072200 02 SELECTR VLV-SYS 2	11	7677	None	Not used (contingency equipment)
40073 CABIN PRESS SENSORS				FUNCTION:
				Provide measurements of cabin pressure and cabin pressure rate of change. Both measurements supply telemetry, dedicated displays and the C&W system.
				Note: The Cabin Pressure Sensor is powered by the same circuit breaker as the System 1 PP02 Controller.
				USAGE:
				Both on continuously throughout all missions
				ANALYSIS USAGE:
40073100 CABIN PRESS SENSOR	1	7677	None	Not used (low power)
40073200 CAB PRES DECAY SENSR	2	7677	101	On from pwr xfr int to EOM
40075 02/N2 FLOW SENSORS				FUNCTION:
				Provide measurements of oxygen and nitrogen flow rates from 0 to 5 lb/hr. The sensors supply telemetry,

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				dedicated displays and the C&W system. Note: Each sensor is powered by the same circuit breaker as the associated PP02 Controller (40070) USAGE: All on continuously on all missions unless the associated PP02 Controller is powered down (see 40070). ANALYSIS USAGE:
40075100 02 FLOW SENSOR-SYS 1	1	7677	None	Not used (low power)
40075200 02 FLOW SENSOR-SYS 2	1	7677	None	Not used (low power)
40075300 N2 FLOW SENSOR-SYS 1	1	7677	None	Not used (low power)
40075400 N2 FLOW SENSOR-SYS 2	1	7677	None	Not used (low power)
40076 PP02 SENSORS				FUNCTION: Provide measurements of the partial pressure of oxygen in the cabin atmosphere. Two of the sensors, located in the cabin air recirculation duct on the mid deck, provide signals to and receive power from the PP02 Controllers (40070). The third, located on the flight deck in the cabin air return duct, provides a telemetry signal only, and is powered by the same circuit breaker as the Cabin Pressure Decay Sensor (40073200). USAGE:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				All on continuously throughout all missions unless the associated PPO2 Controller is powered down (see 40070).
				ANALYSIS USAGE:
40076100 PPO2 SENSOR-SYS 1	1	7677	None	Not used (low power)
40076200 PPO2 SENSOR-SYS 2	1	7677	None	Not used (low power)
40076300 PPO2 SENSOR-SYS 3	1	7677	None	Not used (low power)
40077 CABIN RELF/VNT VLV				FUNCTION:
				Cabin Relief Valves - These valves provide protection in the event of a failure of the associated mechanical relief valve (which limits the cabin positive pressure to 15.75 $\pm$ 0.25 psia) to re-seat after relieving. They are motorized valves which draw power only when moving.
				Cabin Vent Valves - Provide a means of venting the cabin pressure to 14.9 psia, after a prelaunch pressure check at 16.7 psia. They are motorized valves which draw power only when moving.
				USAGE:
				Cabin Relief Valves - On momentarily in the event of a failure of a mechanical relief valve.
				Cabin Vent Valve - On momentarily during prelaunch, no in-flight usage.

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
40077100 CAB PRES RELIEF VL A	5	7677	None	Not used (contingency equipment)
40077200 CAB PRES RELIEF VL B	5	7677	None	Not used (contingency equipment)
40077300 CABIN VENT VALVE A	5	7677	None	Not used (GSE power)
40077400 CABIN VENT VALVE B	5	7677	None	Not used (GSE power)
40078 02/N2 SPY/SLECTR VLS				FUNCTION:
				N2 Supply Valves - Provide isolation for each N2 tank system from the N2 Regulators. They are motorized valves which draw power only when moving (0.5 sec max.)
				N2 Selector Valves - Provide isolation for each N2 regulator from the tank systems. These valves are series-parallel with the supply valves so that either tank system will supply either regulator. They are motorized valves which draw power only when moving (0.5 sec max.)
				02 Supply Valve - Provides isolation for the auxiliary 02 tank from the auxiliary 02 regulator. It is a motorized valve which draws power only when moving (0.5 sec max).
				USAGE:
				Both N2 Supply Valves and the System 1 Selector Valve will remain open throughout all missions except in a contingency situation. The System 2 Selector Valve

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				will remain closed throughout all missions except in a contingency situation. The 02 Supply Valve will remain open except in a contingency situation. All actuations are momentary.
				ANALYSIS USAGE:
40078100 N2 SUPPLY VLV-SYS 1	2	7677	None	Not used (contingency equipment)
40078200 N2 SUPPLY VLV-SYS 2	2	7677	None	Not used (contingency equipment)
40078300 N2 SELECTR VLV-SYS 1	2	7677	None	Not used (contingency equipment)
40078400 N2 SELECTR VLV-SYS 2	2	7677	None	Not used (contingency equipment)
40078500 02 SUPPLY VALVE	2	7677	None	Not used (contingency equipment)
40080 AVIONICS FANS				FUNCTION:
				Circulate air through the avionics bay heat exchangers, for cooling, then into the avionics compartments for cooling equipment. The second fan in each bay is redundant.
				USAGE:
				One fan in each bay is on continuously throughout all missions.
				ANALYSIS USAGE:
40080100 AVION FAN-BAY 1 (A)	166	7677	None	Not used (redundant equipment)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40080210 AVION FAN-BAY 1 (B)	168	7677	101	On from pwr xfr int to EOM
40080300 AVION FAN-BAY 2 (A)	163	7677	101	On from pwr xfr int to EOM
40080410 AVION FAN-BAY 2 (B)	168	7677	None	Not used (redundant equipment)
40080500 AVION FAN-BAY 3 (A)	171	7677	None	Not used (redundant equipment)
40080610 AVION FAN-BAY 3 (B)	168	7677	101	On from pwr xfr int to EOM
40090 AVION BAY SIG COND				FUNCTION: Provide signal conditioning for the fan P, and air and water temperature instrumentation within the avionics bays. There is one set of signal conditioners for each of three avionics bays. USAGE: All three on continuously throughout all missions. ANALYSIS USAGE:
40090100 AVION BAY 1 SIG COND	2	7677	101	On from pwr xfr int to EOM
40090200 AVION BAY 2 SIG COND	2	7677	101	On from pwr xfr int to EOM
40090300 AVION BAY 3 SIG COND	3	7677	101	On from pwr xfr int to EOM

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EPF	ACTIVITY BLOCKS	FUNCTION & USAGE
40100 SMOKE DET SNSRS				FUNCTION: Detect the presence of smoke. USAGE: All on continuously throughout all missions. ANALYSIS USAGE:
40100100 SMOKE DT SNR-L FLT D	6	7677	101	On from pwr xfr int to EOM
40100200 SMOKE DT SNR-R FLT D	6	7677	101	On from pwr xfr int to EOM
40100300 S D SNSR A - BAY 1	6	7677	101	On from pwr xfr int to EOM
40100400 S D SNSR B - BAY 1	6	7677	101	On from pwr xfr int to EOM
40100500 S D SNSR A - BAY 2	6	7677	101	On from pwr xfr int to EOM
40100600 S D SNSR B - BAY 2	6	7677	101	On from pwr xfr int to EOM
40100700 S D SNSR A - BAY 3	6	7677	101	On from pwr xfr int to EOM
40100800 S D SNSR B - BAY 3	6	7677	101	On from pwr xfr int to EOM
40100900 S D SNSR - CABIN	6	7677	101	On from pwr xfr int to EOM

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40110 IMU FANS				FUNCTION: Provide air cooling to the three IMU's. There are three redundant fans in parallel. USAGE: One fan is on continuously whenever an IMU is on. ANALYSIS USAGE:
40110100 IMU FAN A	48	7677	None	Not used (redundant equipment)
40110210 IMU FAN B	49	7677	101	On from pwr xfr int to EOM
40110310 IMU FAN C	49	7677	None	Not used (redundant equipment)
40120 IMU FAN SIG COND				FUNCTION: Provide signal conditioning for IMU fan speed instrumentation. USAGE: On continuously throughout all missions. Note: The three speed signal conditioners are controlled by a single circuit breaker. ANALYSIS USAGE:
40120000 IMU FAN SIG COND	2	7677	101	On from pwr xfr int to EOM

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40130 H20 PUMPS				FUNCTION: Circulate water through the two ARS water loops, providing coolant flow to the three avionics bay heat exchangers and cold plates, hatch, windows, MDM cold plates, liquid cooled garment heat exchanger, potable water chiller, cabin heat exchanger and IMU heat exchanger. USAGE: The single pump loop (loop 2) is the primary loop, with the pump operating continuously. The dual pump loop (loop 1) is a backup loop with only one pump operating at a time. Present planning indicates pump B will be used before going to pump A. Loop 1 pump usage is restricted to periodic loop thermal conditioning (approximately 6 min every 4 hours) in nominal operation. ANALYSIS USAGE:
40130100 H20 PUMP-LOOP 1 (A)	195	7677	None	Not used (redundant equipment)
40130210 H20 PUMP-LOOP 1 (B)	196	7677	107,433	On for 6 min every 4 hrs during orbital operations. On manually for 6 min starting at deorbit prep plus 2 hrs 38 min.
40130300 H20 PUMP-LOOP 2	192	7677	101	On from pwr xfr int to EOM
40140 H20 BYPASS VALVES				FUNCTION:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Regulate the amount of water bypassing the cabin air heat exchanger in order to provide constant cooling to the avionics bay cold plates. The valves are motor driven and require power only while moving. USAGE: During periods of high payload heat loads, the valve in the active loop will be driven to the full bypass position. This requires approximately 1 min (duty cycle TBD). ANALYSIS USAGE:
40140100 H20 BYPASS VALVE-PRI	16	7677	None	Not used
40140210 H20 BYPASS VALVE-SEC	16	7677	None	Not used
40150 H20 BYPASS CNTLR SIG COND				FUNCTION: Provide signal conditioning for quantity, pressure, temperature, and valve position instrumentation associated with the water pump packages. USAGE: Both on continuously throughout all missions. ANALYSIS USAGE:
40150100 H20 BYPASS CN SC-PRI	6	7677	101	On from pwr xfr int to EOM
40150200 H20 BYPASS CN SC-SEC	6	7677	101	On from pwr xfr int to EOM

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40160 SOL COL SLINGER				FUNCTION: Deposits solid waste material and any entrained liquid on the inside walls of the waste collector. USAGE: Approximately 6 min per crew man-day. ANALYSIS USAGE:
40160000 SOL COL SLINGER	40	7677	425	Solid waste management is scheduled once per 24-hr day for single shift operations and twice per 24-hr day for two shift operations. Usage during these periods is a function of crew size, as follows: Single shift - 6 min times the crew size Two shift - 3 min times the crew size
40170 WTR SEPS-WASTE SYS				FUNCTION: Provide air flow to direct solid waste into the solids collection slinger, to remove urine from the urinal, and to remove wash water from the personal hygiene station. In addition, they collect water from the PLSS during recharge. The units then separate liquids from air, route the liquids to the waste tank, and return the filtered air to the cabin. The two units are redundant. USAGE:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Voiding - 6 min/usage; 1/man-day Micturation - 1 min/usage; 6/man-day Washing Hands - 1 min/usage; 3/man-day Shaving - 4 min/usage; 1/man-day Brushing Teeth - 2 min/usage; 2/man-day Washing Body - 7 min/usage; 1/man-day PLSS Recharge - 4 min/usage; 1/PLSS recharged (POST EVA)
				ANALYSIS USAGE:
40170100 WTR SEP-WASTE SYS 1	220	7677	419,425,427	OFT - Waste Management (single shift) - Scheduled once per 24-hr day with a duration of 12 min times the crew size Waste Management (two shift) - Scheduled twice per day with a duration of 6 min times the crew size OPS - Same as OFT usage including on for 8 min, starting 1.5 hrs after each scheduled EVA. Additional usage is a function of crew size and shift description, as follows: Personal Hygiene (single shift) - On during each pre and post sleep period with a duration of 9 min times the crew size Personal Hygiene (two shifts) - On during each pre and post sleep period with a duration of 4 min 30 sec times the crew size
40170210 WTR SEP-WASTE SYS 2	220	7677	None	Not used (redundant equipment)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40191 WASTE H20 TNK VALVES				FUNCTION: Inlet Valves - Provide for isolation of the waste water tanks from the ARS condensing heat exchanger and from the waste water separator. The valves use latching solenoids to conserve power and are normally latched open during a flight. Drain valves - Provide for isolation of the waste water tanks from the drain quick disconnects. The valves also use latching solenoids and are normally closed during a flight. Note: The second waste tank will be used as a potable water tank during OFT. The OFT usage is described under item number 40250. USAGE: Power is required only when driving the valves open or closed (spec is 200 ms max.). The valves will not normally be operated during a flight. ANALYSIS USAGE:
40191100 WASTE TK 1 IN VL - OP	49	7677	None	Not used (contingency usage)
40191110 WASTE TK 1 IN VL - CL	49	7677	None	Not used (contingency usage)
40191200 WASTE TK 1 DRN VL - OP	49	7677	None	Not used (contingency usage)
40191210 WASTE TK 1 DRN VL - CL	49	7677	None	Not used (contingency usage)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40191300 WASTE TK 2 IN VL - OP	49	7600	None	OFT - N/A OPS - Not used (contingency usage)
40191310 WASTE TK 2 IN VL - CL	49	7600	None	OFT - N/A OPS - Not used (contingency usage)
40191400 WASTE TK 2 DRN VL - OP	49	7600	None	OFT - N/A OPS - Not used (contingency usage)
40191410 WASTE TK 2 DRN VL-CL	49	7600	None	OFT - N/A OPS - Not used (contingency usage)
40192 WASTE DUMP ISOL VLV				FUNCTION: Provides a backup for the waste water dump valves failure to close. The valve is normally positioned closed during a flight. USAGE: Power is required only when driving the valve open or closed (spec is 200 ms max.). The valve will not normally be operated during a flight. ANALYSIS USAGE:
40192000 WASTE DMP ISOL VL - OP	49	7677	None	Not used (contingency usage)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40192010 WASTE DMP ISOL VL - CL	49	7677	None	Not used (contingency usage).
40193 WASTE H20 DUMP VLV				FUNCTION: Controls the dumping of waste water overboard through the waste dump nozzle. The valve is normally positioned closed and is only opened to perform a waste dump. USAGE: Power is required only when driving the valve open or closed (spec is 200 ms max.). The valve will be opened for 2.5 hr to perform each waste water dump. A dump is required approximately every 16.5 man-days when one tank is available (OFT) or 33 man-days when two tanks are available (OPS). ANALYSIS USAGE:
40193000 WASTE H20 DMP VL - OP	49	7677	None	Not used (momentary power)
40193010 WASTE H20 DMP VL - CL	49	7677	None	Not used (momentary power)
40210 WATER HTR-FOOD/HYG				FUNCTION: Heats water to 160 +/- 5 deg F for use in meal preparation and personal hygiene. USAGE: The crew activates this heater on-orbit and deactivates it prior to deorbit. Heating a full tank of water

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				requires approximately 1.5 hrs. There is a continuous 35 watt heat leak. The requirement for meals is approxmately 179.5 w-hr/man-day. The requirement for personal hygiene is approximately 53.9 w-hr/man-day.
				ANALYSIS USAGE:
40210000 WATER HTR-FOOD/HYG	500	7600	107,423,427, 433	OFT - N/A
				OPS - On for 1.5 hrs, starting at the end of ascent reconfiguration. Then on with a 7% usage factor until 1.0 hrs prior to deorbit. Additional usage is a function of crew size and shift description, as follows:
				Food preparation (single shift) - On for 1.5 hrs starting 30 min prior to each scheduled eat period, with a usage factor equivalent to 7.98% per crewman
				Food preparation (two shifts) - On for 1.5 hrs starting 30 min prior to each scheduled eat period, with a usage factor equivalent to 4.79% per crewman
				Personal hygiene (single shift) - On for 45 min during each pre and post sleep period, with a usage factor equivalent to 7.19% per crewman
				Personal hygiene (two shifts) - On for 45 min during each pre and post sleep period, with a usage factor equivalent to 3.60% per crewman
40220 OVEN HEATER				FUNCTION:
				Heats food to 180 deg F, then cycles as required to maintain the temperature above 145 deg F. The oven will hold enough items to prepare seven meals sim-

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ultaneously. USAGE: On for 40 min/meal to heat 21 thermostabilized items. This is a full meal complement for a seven man crew. The requirement is not appreciably less for fewer items. Note: Heater cycling after the initial 40 min period is not anticipated. ANALYSIS USAGE:
40220000 OVEN HTR	405	7600	423	OFT - N/A OPS - On for 40 Min starting 30 min prior to each scheduled eat period
40230 OVEN FANS				FUNCTION: Provide convective air flow for heating food and for maintaining the food temperature after heating. The heat from fan operation makes up the heat leak from the oven, enabling food to be maintained above 145 deg F without heater usage. USAGE: On whenever the oven heater is on during meal preparation and for the duration of the eat period. The three fans operate simultaneously. ANALYSIS USAGE:
40230100 OVEN FAN #1	32	7600	423	OFT - N/A

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - For crew sizes of 2, 3, 4, 6, or 7 men, and for a crew size of 5 men working two shifts - on for 1.33 hrs starting 30 min prior to each scheduled eat period; for a crew size of 5 men working a single shift - on for 2.33 hrs starting 30 min prior to each scheduled eat period
40230200 OVEN FAN #2	32	7600	423	OFT - N/A OPS - Same as 40230100
40230300 OVEN FAN #3	32	7600	423	OFT - N/A OPS - Same as 40230100
40231 FOOD WARMER - OFT				FUNCTION: Plug in type food warmer to be used on flights which have no galley. USAGE: Approximately 1 hr per meal per crew member. Warmer has four compartments each of which can accomodate a meal. A single thermostat maintains the compartments at approximately 175° F. Note: For analysis purposes, this component has been divided into two parts in order to keep the phase loads correct.
				ANALYSIS USAGE:
40231100				

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
FOOD WARMER - OFT PHA	203	2077	423	OFT - On 2 hours prior to each scheduled meal OPS - N/A
40231200 FOOD WARMER - OFT PHC	203	2077	423	OFT - Same as 40231100 OPS - N/A
40250 POT H20 TANK VLVS				FUNCTION: Inlet valves - Provide for isolation of the potable water tanks from water coming from the fuel cells. Outlet valves - Provide for isolation of the potable water tanks from the galley, flash evaporators, air-lock, and dump nozzle. USAGE: Power is required only when driving the valves open or closed (spec is 200 ms max.). The management scheme for the OFT is as follows: During ascent, the inlets for tanks A, B, C, and D, and the outlets for tanks B, C, and D will be open, the tank A outlet will be closed. With the Outlet Iso Vlv (40263) closed, this provides water to two redundant FES Lines from separate tanks. This same cofiguration will be maintained during on-orbit operations. For descent all inlets and outlets will be open. With the Outlet Iso Valve opened, this provides maximum water availability with minimum reconfiguration. Note: Following OFT the fourth potable water tank ("D") will be converted to a waste tank. The operational usage of the second waste

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				tank is described under item number 40191. The potable tank management scheme for the three tank operational configuration has not been formulated in detail but will be similar to the above.
				ANALYSIS USAGE:
40250100 POT TK A IN VLV - OP	49	7677	None	Not used (momentary power)
40250110 POT TK A IN VLV - CL	49	7677	None	Not used (momentary power)
40250200 POT TK A OUT VLV - OP	49	7677	None	Not used (momentary power)
40250210 POT TK A OUT VLV - CL	49	7677	None	Not used (momentary power)
40250300 POT TK B IN VLV - OP	49	7677	None	Not used (momentary power)
40250310 POT TK B IN VLV - CL	49	7677	None	Not used (momentary power)
40250400 POT TK B OUT VLV - OP	49	7677	None	Not used (momentary power)
40250410 POT TK B OUT VLV - CL	49	7677	None	Not used (momentary power)
40250500 POT TK C IN VLV - OP	49	7677	None	Not used (momentary power)
40250510 POT TK C IN VLV - CL	49	7677	None	Not used (momentary power)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40250600 POT TK C OUT VLV - OP	49	7677	None	Not used (momentary power)
40250610 POT TK C OUT VLV - CL	49	7677	None	Not used (momentary power)
40250700 POT TK D IN VLV - OP	49	0077	None	Not used (momentary power)
40250710 POT TK D IN VLV - CL	49	0077	None	Not used (momentary power)
40250800 POT TK D OUT VLV - OP	49	0077	None	Not used (momentary power)
40250810 POT TK D OUT VLV - CL	49	0077	None	Not used (momentary power)
40261 POT H20 DUMP ISO VLV				FUNCTION: Provides a backup for the potable water dump valve failure to close. The valve is normally positioned closed during a flight. USAGE: Power is required only when driving the valve open or closed (spec is 200 ms max.). The valve will be opened to perform any water dumps; however, no requirement to perform a water dump is anticipated on a nominal mission. ANALYSIS USAGE:
40261000 POT H20 DMP ISO V - OP	49	7677	None	Not used (contingency usage)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40261010 POT H20 DMP ISO V - CL	49	7677	None	Not used (contingency usage)
40262 POT H20 DUMP VLV				FUNCTION: Controls the dumping of excess potable water overboard through the water dump nozzle. The valve is normally positioned closed and is only opened to perform a water dump. USAGE: Power is required only when driving the valve open or closed (spec is 200 ms max.). The valve will be opened to perform any water dumps; however, no requirement to perform a water dump is anticipated on a nominal mission. ANALYSIS USAGE:
40262000 POT H20 DMP VLV - OP	49	7677	None	Not used (contingency usage)
40262010 POT H20 DMP VLV - CL	49	7677	None	Not used (contingency usage)
40263 POT H20 XOVER VL				FUNCTION: Provides isolation between the outlets of tanks A & B and the outlets of the remaining tanks. The valve is postioned closed during ascent for leak isolation. USAGE: Power is required only when driving the valve open

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				or closed (spec is 200 ms max.). The valve will be closed for ascent, opened when on-orbit, and re-closed prior to deorbit.
				ANALYSIS USAGE:
40263000 POT H20 XOVER VL - OP	49	7677	None	Not used (momentary power)
40263010 POT H20 XOVER VL - CL	49	7677	None	Not used (momentary power)
40270 POT H20 GALLEY SPY V				FUNCTION:
				Provides isolation between the potable water tank outlets and the galley. The valve is positioned closed during ascent and descent for leak protection and open on-orbit to supply water to the galley.
				USAGE:
				Power is required only when driving the valve open or closed (spec is 200 ms max.). The valve will be closed for ascent, opened when on-orbit, and re-closed prior to deorbit.
				ANALYSIS USAGE:
40270000 POT H20 GLY SP VL - OP	49	7677	None	Not used (momentary power)
40270010 POT H20 GLY SP VL - CL	49	7677	None	Not used (momentary power)
40280 POT H20 SEC FES VLV				FUNCTION:
				Provides isolation between the potable water tank out-

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				let and the secondary flash evaporator line. The valve is normally positioned open during a flight.
				USAGE:
				Power is required only when driving the valve open or closed (spec is 200 ms max.). The valve will be operated only in a contingency.
				ANALYSIS USAGE:
40280000 POT H20 SEC FES V - OP	49	7677	None	Not used (contingency usage)
40280010 POT H20 SEC FES V - CL	49	7677	None	Not used (contingency usage)
40290 FREON PUMPS				FUNCTION:
				Circulate freon coolant throughout the Orbiter for heat removal from the various systems and for transfer of heat to the radiators, ammonia boiler system, and flash evaporator. There are two redundant pumps in each of two loops. Operation of both loops is required.
				USAGE:
				One on continuously in each loop throughout all missions. The power level is a function of total loop pressure drop (i.e. power demand decreases when radiators are deployed).
				ANALYSIS USAGE:
40290100 FREON PMP LP 1-A ASC	374	7677	005,109,123, 435,437,457	On from pwr xfr int until radiator deployment; on from 30 sec after initiation of the PLB doors close

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				sequence until EOM
40290120 FREON PMP LP 1-A 6PL	352	7677	None	Not used
40290130 FREON PMP LP 1-A 8PL	364	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB door close sequence
40290210 FREON PMP LP 1-B ASC	374	7677	None	Not used (redundant equipment)
40290220 FREON PMP LP 1-B 6PL	352	7677	None	Not used
40290230 FREON PMP LP 1-B 8PL	364	7677	None	Not used (redundant equipment)
40290300 FREON PMP LP 2-A ASC	374	7677	005,109,123, 435,437,457	On from pwr xfr int until radiator deployment; on from 30 sec after initiation of the PLB doors close sequence until EOM
40290320 FREON PMP LP 2-A 6PL	352	7677	None	Not used
40290330 FREON PMP LP 2-A 8PL	364	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40290410 FREON PMP LP 2-B ASC	374	7677	None	Not used (redundant equipment)
40290420 FREON PMP LP 2-B 6PL	352	7677	None	Not used
40290430 FREON PMP LP 2-B 8PL	364	7677	None	Not used (redundant equipment)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40300 RAD FLOW CNTLS - LP 1				FUNCTION: Control loop 1 freon flow through the radiator, to maintain the loop 1 radiator outlet temperature at 38 +/- 2 deg F, during normal operations, or 57 +/- 2 deg F, during flash evaporator system operations (selectable by the crew). The active controller automatically bypasses the radiator if the loop 1 radiator outlet temperature falls to 33 +/- 1 deg F (Fault Mode). USAGE: Manually controlled by the crew. One controller will be on from payload bay doors open until payload bay doors closed. Fault detection for both controllers is on whenever either controller is on. ANALYSIS USAGE:
40300100 RAD FLOW CNTLR A-LP1	2	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40300200 RD FL CTR A-LP1 FALT	2	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40300310 RAD FLOW CNTLR B-LP1	2	7677	None	Not used (redundant equipment)
40300400 RD FL CTR B-LP1 FALT	2	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40310				

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
RAD FLOW CNTLS - LP 2				FUNCTION:
				Control the loop 2 Freon flow through the radiator, to maintain the loop 2 radiator outlet temperature at 38 +/- 2 deg F, during normal operations, or 57 +/- 2 deg F, during flash evaporator system operations (selectable by the crew). The active controller automatically bypasses the radiator if the loop 2 radiator outlet temperature falls to 33 +/- 1 deg F (Fault Mode).
				USAGE:
				Manually controlled by the crew. One controller will be on from payload bay doors open until payload bay doors closed. Fault detection for both controllers is on whenever either controller is on.
				ANALYSIS USAGE:
40310100 RAD FLOW CNTLR A-LP2	2	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40310200 RD FL CTR A-LP 2 FALT	2	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40310310 RAD FLOW CNTLR B-LP2	2	7677	None	Not used (redundant equipment)
40310400 RD FL CTR B-LP2 FALT	2	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40320 RAD FLOW CNTL VLV'S				FUNCTION:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Operate, under control of the radiator flow controllers, to vary the flow of freon through the radiator as a function of the radiator outlet temperature (see 40300 and 40310).
				USAGE:
				Power is required only when driving the valves open or closed. It is estimated that, when a controller is active, its associated flow control valve will be driving all, or almost all, the time.
				ANALYSIS USAGE:
40320100 RAD FL CNTL VLV-LP1	6	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40320200 RAD FL CNTL VLV-LP2	6	7677	005,435,437	On from radiator deployment until 30 sec after initiation of the PLB doors close sequence
40330 RAD BYPASS VLV'S				FUNCTION:
				Bypass flow around the radiator during periods in which the PLB doors are closed and whenever the radiator outlet temperature falls to 33 +/- 1 deg F.
				USAGE:
				Power is required only when driving the valves open or closed. Drive time is approximately three seconds.
				ANALYSIS USAGE:
40330100 RAD BYP VLV MTR1-LP1	14	7677	None	Not used (momentary power)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40330210 RAD BYP VLV MTR2-LP1	14	7677	None	Not used (momentary power)
40330300 RAD BYP VLV MTR1-LP2	14	7677	None	Not used (momentary power)
40330410 RAD BYP VLV MTR2-LP2	14	7677	None	Not used (momentary power)
40350 FREON FLOW PROPOR VALVES				FUNCTION: Control the freon flow split between the water/freon loop interchanger and the payload heat exchanger. There is one valve per loop. The valves are momentary operation, latching valves. Drive time is approximately three seconds. USAGE: Momentary actuation only. ANALYSIS USAGE:
40350100 FREON FL PROPVL LP1	34	7677	None	Not used (momentary power)
40350200 FREON FL PROPVL LP2	34	7677	None	Not used (momentary power)
40360 FREON COOL LP INSTR				FUNCTION: Provide signal conditioning for freon coolant loop instrumentation.

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				On continuously throughout all missions.
				Note: Freon coolant loop instrumentation power is controlled by the same switch that controls OAI MDM power (see 07110).
				ANALYSIS USAGE:
40360100 FREON COOL LP1 INSTR	5	7677	101	On from pwr xfr int to EOM
40360200 FREON COOL LP2 INSTR	5	7677	101	On from pwr xfr int to EOM
40370 FLASH EVAP CONTROLLERS				FUNCTION:
				Control isolation/pulsing valves in the flash evaporators. Both evaporators are used from 140,000 feet to radiator deployment and from the closing of the payload bay doors to 83,000 feet. One evaporator is also used to supplement radiator heat rejection on-orbit, by rejecting excess water generated by the fuel cells. When the potable H_2O tank is full the crew will partially bypass the radiator. Warm coolant will then trigger flash evaporator operation.
				USAGE:
				Controller #1 is enabled by the computer during ascent at 140,000 feet and disabled by the crew after descent at 83,000 feet. A redundant controller may be manually selected by the crew, after controller #1 is deactivated. It is not planned to have two, or more controllers on simultaneously.

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
40370100 FES CONTROLLER PRI A	8	7677	103,105,501, 503	On from L/O + 1 min 54 sec until EI + 25 min 23 sec
40370210 FES CONTROLLER PRI B	8	7677	None	Not used (redundant equipment)
40370310 FES CONTROLLER SEC	8	7677	None	Not used (redundant equipment)
40380 FES HI LOAD PLSR VLVS				FUNCTION: Control the flow of feedwater to the high load flash evaporator. The valves operate under control of the active FES controller (see 40370) and in conjunction with the topping pulser valve (see 40390), to maintain the FES outlet temperature at 37 +/- 2 deg F during ascent and descent. USAGE: Primary pulsed open at a variable frequency from 140,000 feet during ascent until inhibited any time after the radiator panels are deployed and from radiator panel retraction until descent to 100,000 feet.
				ANALYSIS USAGE:
40380100 FES HI LD PLSR V-PRI	30	7677	005,123,435, 437,457,501, 503	On with a 100% usage factor from 2 min 5 sec after L/O until radiator deployment; On with a 100% usage factor from 25 sec after initiation of the PLB doors close sequence until approx 100 K ft. (24 min 25 sec after entry interface)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40380210 FES HI LD PLSR V-SEC	30	7677	None	Not used (redundant equipment)
40381 FES HI LD ISOL VLVS				FUNCTION: Provide redundant sealing of the feedwater line during quiescent periods and backup operation to the high load pulser valves if they fail open. USAGE: Pulsed simultaneously with the high load pulser valves (see 40380). ANALYSIS USAGE:
40381100 FES HI LD ISO VL-PRI	30	7677	005,123,435, 437,457,501, 503	On with a 100% usage factor from 2 min 5 sec after L/O until radiator deployment; on with a 100% usage factor from 25 sec after initiation of the PLB doors close sequence until approx 100 K ft. (24 min 25 sec after entry interface)
40381210 FES HI LD ISO VL-SEC	30	7677	None	Not used (redundant equipment)
40390 FES TOPPING PLSR VLVS				FUNCTION: Control the flow of feedwater to the topping flash evaporator. The valves operate under control of the active FES controller (see 40370) and in conjunction with the high load pulser valves (see 40380), to maintain the FES Outlet temperature at 39 $\pm$ 1 deg F during ascent and descent. In addition, they are used on-orbit to supplement the ATCS radiators and for dumping excess fuel cell water.

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Primary pulsed open at a variable frequency from 140,000 feet during ascent until inhibited any time after the radiator panels are deployed and from radiator panel retraction until descent to 100,000 feet. The duty cycle while on-orbit is a function of the Orbiter heat load and the fuel cell power level.
				ANALYSIS USAGE:
40390100 FES TOP'G PLSR V-PRI	30	7677	005,123,435, 437,457,501, 503	On with a 100% usage factor from 2 min 5 sec after L/O until radiator deployment, then on with a 27% usage factor until 25 sec after initiation of the PLB doors close sequence, then on with a 100% usage factor until descent to approx 100 K feet (24 min 25 sec after entry interface)
40390210 FES TOP'G PLSR V-SEC	30	7677	None	Not used (redundant equipment)
40391 FES TOPPING ISOL VLVS				FUNCTION:
				Provide redundant sealing of the feedwater line during quiescent periods and isolation of the feedwater following a failure of the topping pulser valve.
				USAGE:
				Duty cycle is a function of attitude and thermal conditions. It is anticipated, however, that the energy expended in opening the active valve will be negli-

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				gible, since each open cycle takes approximately 5 milliseconds. After temperature control initiation, the active valve is maintained open by the corresponding low power holding coil (see 40392).
				ANALYSIS USAGE:
40391100 FES TOP'G ISO VL-PRI	30	7677	None	Not used (redundant equipment)
40391210 FES TOP'G ISO VL-SEC	30	7677	None	Not used (redundant equipment)
40392 TPNG VLV HOLDING COILS				FUNCTION:
				Hold topping isolation valves open after initiation of temperature control.
				USAGE:
				Duty cycle is a function of attitude and thermal conditions.
				ANALYSIS USAGE:
40392100 TPNG V HLDNG COIL-PR	4	7677	005,123,435, 437,457,501, 503	On from 2 min 5 sec after L/O until radiator deployment, then on with an 80% usage factor until 25 sec after initiation of the PLB doors closed sequence, then on until descent to approx 100 K feet (24 min 25 sec after entry interface)
40392210 TPNG V HLDNG COIL-SC	4	7677	None	Not used (redundant equipment)
40500 NH3 SYSTEM CNTLR'S				FUNCTION:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Maintain the freon outlet temperature of the ammonia boiler at 34 +/- 3 deg F from 100,000 ft, during descent, until 15 min after touchdown.
				USAGE:
				Both controllers are enabled during deorbit preps and remain enabled until approximately 15 min after touchdown.
				ANALYSIS USAGE:
40500100 NH3 SYSTEM CNTLR A	6	7677	051,109,433	STS-1 - On from 30 min prior to until 30 min after the rehearsal deorbit and from 30 min prior to deorbit until EOM
				STS-2 - On from 30 min prior to deorbit until EOM
				OPS - On from 30 min prior to deorbit until EOM
40500200 NH3 SYSTEM CNTLR B	6	7677	051,109,433	Same as 40500100
40510 NH3 ISOLATION VALVES				FUNCTION:
				Operate, under control of their corresponding NH3 controllers (see 40500), to provide NH3 to the ammonia boiler. The valves are normally closed, powered open.
				USAGE:
				Each valve is continuously powered by its respective controller. The valves are turned on by the GPC at approx 100,000 ft during descent.
				ANALYSIS USAGE:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40510100 NH3 ISO VLV - SYS A	10	7677	509	On from 6 min 32 sec prior to touchdown until EOM
40510200 NH3 ISO VLV - SYS B	10	7677	509	Same as 40510100
40520 NH3 CONTROL VALVES				FUNCTION: Control the flow of ammonia to the NH3 boiler. The valves modulate ammonia flowrates, under control of their respective controllers (see 40500), to maintain the boiler freon outlet temperature at 34 +/- 3 deg F. There are two serial, normally open, operationally redundant valves in each system. USAGE: The active valve in each system, is continually modulated by its respective NH3 controller. (see 40500). The valves are turned on by the GPC at approx 100 K feet during descent. ANALYSIS USAGE:
40520100 NH3 CNTL VLV#1-SYS A	8	7677	509	On from 6 min 32 sec prior to touchdown until EOM
40520210 NH3 CNTL VLV#2-SYS A	8	7677	None	Not used (redundant equipment)
40520300 NH3 CNTL VLV#1-SYS B	8	7677	509	On from 6 min 32 sec prior to touchdown until EOM
40520410 NH3 CNTL VLV#2-SYS B	8	7677	None	Not used (redundant equipment)
40600				

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
VACUUM VENT NOZ HTR				FUNCTION: Precludes water vapor from freezing at the nozzle (moisture contributors are commode and airlock). USAGE: Heaters are not thermostatically controlled. They are turned on or off from the mid deck panel ML31C and are on continuously from approximately L/O plus 4 hrs to deorbit prep. ANALYSIS USAGE:
40600000 VACUUM VNT NOZ HTR	11	7677	600 series	See appendix B heater tables
40601 VACUUM VNT LNE HTRS				FUNCTION: Preclude water vapor from freezing in the line (moisture contributors are commode and airlock). USAGE: Heaters are thermostatically controlled. They are enabled or disabled by circuit breakers on panel ML86B. They will be disabled until approximately 4 hrs after L/O. The same CB also provides power to potable H20 dump line heaters (ref 40611) and the waste H20 dump line heaters (ref 40621). Duty cycles are a function of line temperatures due to water dumps and attitude variations. ANALYSIS USAGE:
40601100 VACUUM VNT LNE HTR A	28	7677	600 series	See appendix B heater tables

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40601210 VACUUM VNT LNE HTR B	28	7677	None	Not used (redundant equipment)
40610 POT H20 NOZ HTR				FUNCTION: Precludes ice formation at the water dump nozzle during a potable water dump. USAGE: When a potable water dump is required, usage would be: On from 2 min prior to the dump, through 1.5 hr dump, and for 30 min following the dump. ANALYSIS USAGE:
40610000 POT H20 NOZ HTR	21	7677	None	Not used (contingency equipment)
40611 POT H20 DUMP LN HTRS				FUNCTION: Preclude ice formation in the water dump line during a potable water dump. USAGE: Heaters are thermostatically controlled. They are enabled or disabled by circuit breakers on panel ML86B. They will be disabled until approximately 4 hrs after L/O. The same CB also provides power to the vacuum vent line heaters (ref 40601) and the waste H20 dump line heaters (ref 40621). Duty cycles are a function of line temperatures due to water dumps and attitude variations. ANALYSIS USAGE:

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40611100 POT H20 DUMP LN HTRA	13	7677	600 series	See appendix B heater tables
40611210 POT H20 DUMP LN HTRB	13	7677	None	Not used (redundant equipment)
40620 WASTE NOZZLE HTR				FUNCTION: Maintains temperatures above 40 deg F to preclude ice formulation in the waste dump nozzle during a dump. USAGE: On from 2 min prior to a waste water dump, during the dump, and for 30 min after the dump. There will be one dump every 28 man-days. ANALYSIS USAGE: On for 3 hrs 5 min every 28 man-days. See appendix B for additional usage
40620000 WASTE NOZZLE HTR	22	7677	105, 600 series	
40621 WASTE DMP LINE HTRS				FUNCTION: Maintain temperatures above 40 deg F to preclude ice formation in the waste water line during a dump. USAGE: Heaters are thermostatically controlled. They are enabled or disabled by circuit breakers on panel ML86B. They will be disabled until approximately 4 hrs after L/O. The same CB also provides power to the vacuum vent line heaters (ref 40601) and the potable H20 dump line heaters (ref 40611). Duty cycles are a

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				function of line temperatures due to water dumps and attitude varations.
				ANALYSIS USAGE:
40621100 WASTE DMP LINE HTR A	15	7677	600 series	See appendix B heater tables
40621210 WASTE DMP LINE HTR B	15	7677	None	Not used (redundant equipment)
40810 PRI FDWTR LINE HTRS				FUNCTION:
				Heat the port side water lines between the cabin and the flash evaporator system.
				USAGE:
				Heaters are redundant and thermostatically controlled. They are enabled or disabled from a switch on panel L2A1. They will be disabled between approximately T-5 min and sometime prior to payload bay door deployment. Although enabled, no usage of the primary system is expected until approximately 90 min after launch.
				ANALYSIS USAGE:
40810100 PRI FWTR LN HTA-TS5	21	7677	600 series	See appendix B heater tables
40810210 PRI FWTR LN HTB-TS8	21	7677	None	Not used
40810300 PRI FWTR LN HTA-TS6	21	7677	600 series	See appendix B heater tables
40810410				

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
PRI FWTR LN HTB-TS9	21	7677	None	Not used
40810500 PRI FWTR LN HTA-TS7	51	7677	600 series	See appendix B heater tables
40810610 PRI FWTR LN HTB-TS10	51	7677	None	Not used
40810700 PRI FWTR LN HTA-TS5	43	7677	600 series	See appendix B heater tables
40810810 PRI FWTR LN HTB-TS2	43	7677	None	Not used
40820 SEC FDWTR LINE HTRS				FUNCTION: Heat the starboard side water lines between the cabin and the flash evaporator system. USAGE: Heaters are redundant and thermostatically controlled. They are enabled or disabled from a switch on panel L2A1. They will be disabled between approximately T-5 min and sometime prior to payload bay door deployment. ANALYSIS USAGE:
40820100 SEC FWTR LN HTA-TS11	21	7677	Asc,Des, 600 series	See appendix B heater tables
40820210 SEC FWTR LN HTB-TS14	21	7677	None	Not used
40820300				

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
SEC FWTR LN HTA-TS12	21	7677	Asc,Des, 600 series	See appendix B heater tables
40820410 SEC FWTR LN HTB-TS15	21	7677	None	Not used
40820500 SEC FWTR LN HTA-TS13	51	7677	Asc,Des, 600 series	See appendix B heater tables
40820610 SEC FWTR LN HTB-TS16	51	7677	None	Not used
40820700 SEC FWTR LN HTA-TS3	48	7677	Asc,Des, 600 series	See appendix B heater tables
40820810 SEC FWTR LN HTB-TS4	48	7677	None	Not used
40850 HI LD DUCT HTRS (SEC 1)				FUNCTION: Maintain the duct wall temperatures within the range of 150 to 250 deg F, to preclude ice formation and subsequent duct blockage. USAGE: Used during high load evaporator operation. One on during ascent until radiator deployment. One on during descent from entry interface until 100K ft. ANALYSIS USAGE:
40850100 HI LD DUCT HTR1 SEC1	554	7677	Asc,Des,005, 435,457	See appendix B heater tables

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40850210 HI LD DUCT HTR2 SEC1	536	7677	None	Not used (redundant equipment)
40850310 HI LD DUCT HTR3 SEC1	566	7677	None	Not used (redundant equipment)
40860 HI LD DUCT HTRS (SEC2)				FUNCTION: Maintain the duct wall temperatures within the range of 150 to 250 deg F, to preclude ice formation and subsequent duct blockage. USAGE: Used during high load evaporator operation. One on during ascent until radiator deployment. One on during descent from entry interface until 100 K ft. ANALYSIS USAGE:
40860100 HI LD DUCT HTR1 SEC2	255	7677	Asc,Des,005, 435,457	See appendix B heater tables
40860210 HI LD DUCT HTR2 SEC2	256	7677	None	Not used (redundant equipment)
40860310 HI LD DUCT HTR3 SEC2	261	7677	None	Not used (redundant equipment)
40870 HI LD DUCT NOZ HTRS				FUNCTION: Maintain nozzle temperature at a level which precludes ice formation and subsequent nozzle blockage.

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Used during high load evaporator operation. One on during ascent deployment. One on during descent from entry interface until 100 K ft.
				ANALYSIS USAGE:
40870100 HI LD DCT NOZ HT GP1	131	7677	Asc,Des,005, 435,457	See appendix B heater tables
40870210 HI LD DCT NOZ HT GP2	130	7677	None	Not used (redundant equipment)
40870310 HI LD DCT NOZ HT GP3	131	7677	None	Not used (redundant equipment)
40900 TOP'G DUCT HTRS (SEC1)				**FUNCTION:**
				Maintain duct walls at such a temperature that ice cannot form and evaporation of residual water will occur.
				USAGE:
				Used during topping evaporator operations. Evaporation heaters are powered preflight to post rollout, but thermostatically controlled.
				ANALYSIS USAGE:
40900100 TOP'G DUCT HTR1 SEC1	379	7677	Asc,Des,005, 600 series	See appendix B heater tables
40900210 TOP'G DUCT HTR2 SEC1	383	7677	None	Not used (redundant equipment)

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
40900310 TOP'G DUCT HTR3 SEC1	368	7677	None	Not used (redundant equipment)
40910 TOP'G DUCT HTRS (SEC2)				FUNCTION: Maintain duct walls at such a temperature that ice cannot form and evaporation of residual water will occur. USAGE: During topping evaporator operations. Evaporation heaters are powered preflight to post rollout, but thermostatically controlled. ANALYSIS USAGE:
40910100 TOP'G DUCT HTR1 SEC2	469	7677	Asc,Des,005, 600 series	See appendix B heater tables
40910210 TOP'G DUCT HTR2 SEC2	480	7677	None	Not used (redundant equipment)
40910310 TOP'G DUCT HTR3 SEC2	478	7677	None	Not used (redundant equipment)
40920 TOP'G DUCT HTRS (SEC3)				FUNCTION: Same as 40910 USAGE: Same as 40910

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
40920100 TOP'G DUCT HTR1 SEC3	63	7677	Asc,Des,005, 600 series	See appendix B heater tables
40920210 TOP'G DUCT HTR2 SEC3	65	7677	None	Not used (redundant equipment)
40930 TOP'G DUCT HTRS (SEC4)				FUNCTION: Same as 40910 USAGE: Same as 40910
				ANALYSIS USAGE:
40930100 TOP'G DUCT HTR1 SEC4	65	7677	Asc,Des,005, 600 series	See appendix B heater tables
40930210 TOP'G DUCT HTR2 SEC4	65	7677	None	Not used (redundant equipment)
40940 SONIC LEFT NOZ HTRS				FUNCTION: Maintain left side sonic nozzle surface temperatures above 40 deg F to preclude ice formation on the nozzle surfaces. USAGE: One heater is enabled continuously and is thermostatically controlled. Heater duty cycle is a function of attitude and beta angle.

TABLE A-XVI.- ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
40940100 SONIC LFT NOZ HTR 1A	25	7677	Asc,Des,005, 600 series	See appendix B heater tables
40940210 SONIC LFT NOZ HTR 1B	25	7677	None	Not used (redundant equipment)
40950 SONIC RHT NOZ HTRS				FUNCTION:
				Maintain right side sonic nozzle surface temperatures above 40 deg F to preclude ice formation on the nozzle surfaces.
				USAGE:
				One heater is enabled continuously and is thermostatically controlled. Heater duty cycle is a function of attitude and beta angle.
				ANALYSIS USAGE:
40950100 SONIC RHT NOZ HTR 2A	25	7677	Asc,Des,005, 600 series	See appendix B heater tables
40950210 SONIC RHT NOZ HTR 2B	25	7677	None	Not used (redundant equipment)

A-XVII 5000
HYDRAULICS

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50010 LANDING GEAR CONTROL VALVE				FUNCTION: Controls hydraulic system #1 high pressure flow to the landing gear control system for landing gear extension and nose wheel steering. This is a three way solenoid valve. When energized it permits hydraulic pressure to act on the unlock side of the landing gear uplock actuators and the extend side of the strut actuators. When de-energized it provides a return path for hydraulic system #1 circ pump flow from the landing gear area. USAGE: Powered by the "Landing Gear Down" command from 25 sec prior to touchdown until the crew initiates the "Landing Gear Reset" command after stoproll. ANALYSIS USAGE: On from 25 sec prior to touchdown until EOM
50010000 LAND GEAR CONTL VLV	18	7677	509	
50030 LANDING GEAR DUMP VALVE				FUNCTION: Opens a hydraulic return path from the uplock, strut, and nosewheel steering actuators to the system #1 reservoir. This dumps hydraulic pressure from the lock side of the uplock actuators and the retract side of the strut actuators. This is a normally closed solenoid valve. USAGE:

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Powered by the "Landing Gear Down" command from 25 sec prior to touchdown until the crew initiates the "Landing Gear Reset" command after stoproll.
				ANALYSIS USAGE:
50030000 LAND GEAR DUMP VLV	18	7677	509	On from 25 sec prior to touchdown until EOM
50040 LANDING GEAR RETRACT CIRCULATION VALVE				FUNCTION:
				Permits hydraulic system #1 flow to the strut, uplock, and nosewheel steering actuators, when energized, for landing gear retract or thermal conditioning during circ pump operation. When de-energized (closed) it prevents hydraulic system #1 pressure from acting on the retract side of the strut actuator and the lock side of the uplock actuator.
				USAGE:
				Energized when Circ Pump #1 is on.
				ANALYSIS USAGE:
50040000 LG RETRACT CIRC VLV	18	7677	201,505, 600 series	On from pwr xfr int to L/O minus 5 min, from stoproll plus 2 min 30 sec to EOM, see appendix B heater tables for on-orbit usage
50050 REDUNDANT SHUTOFF VALVE				FUNCTION:
				Provides redundancy to the LG Retract Circ Valve in the closed position. When energized (closed), it prevents

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				hydraulic system #1 pressure from acting on the retract side of the strut actuators and the lock side of the uplock actuators. USAGE: Powered by the "Landing Gear Arm" command from 30 sec prior to touchdown until the crew initiates the "Landing Gear Reset" command after stoproll. ANALYSIS USAGE: On from 30 sec prior to touchdown until EOM
50050000 REDUND SHUTOFF VLV	18	7677	509	
50060 MAIN PUMP DEPRESS VALVES				FUNCTION: Depressurize the hydraulic pump when energized. Utilized to reduce the hydraulic pump startup torque for APU startup and to prevent switching valves from cycling during APU shutdown. USAGE: Energized for approximately 1 min during each APU startup sequence. Energized for approximately 30 sec during each shutdown. Systems 1 and 3 will also be energized for approximately 30 sec each during post-landing hydraulic test. ANALYSIS USAGE: On for 1 min, 1 min prior to each APU startup: On for 30 sec beginning at: insertion + 1 min 30 sec, APU shutdown during the on-orbit FCS checkout, and at stoproll + 1 min
50060100 MN PMP #1 DEPRES VLV	24	7677	207,211,463 465,505,507	

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50060200 MN PMP #2 DEPRES VLV	24	7677	207,211, 505,507	On for 1 min, 1 min prior to each APU startup. On for 30 sec beginning at: insertion + 1 min 30 sec, and stoproll + 1.5 min
50060300 MN PMP #3 DEPRES VLV	24	7677	207,211, 505,507	On for 1 min, 1 min prior to each APU startup. On for 30 sec beginning at: insertion + 1 min 30 sec, and stoproll + 1 min
50080 RESERVOIR VOLUME SENSORS				FUNCTION: Provide a measurement of fluid volume in the hydraulic reservoir for TM and dedicated displays. USAGE: On continuously throughout all missions. ANALYSIS USAGE:
50080100 RESVOIR #1 VOL SNSR	1	7677	None	Not used (low power)
50080200 RESVOIR #2 VOL SNSR	1	7677	None	Not used (low power)
50080300 RESVOIR #3 VOL SNSR	1	7677	None	Not used (low power)
50090 MPS SYSTEM SHUTOFF VALVES				FUNCTION: When open permits hydraulic fluid flow to the SSME controls (TVC actuators and engine control valves) and

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				the umbilical retract actuators. These are latching valves requiring momentary power to open or close. When closed flow is isolated to the above components and directed through an orifice to the return leg for circulation during circ pump operations. Since they are pilot operated valves the circ pumps or APU's must be operating for the valves to actuate. USAGE: Closed at completion of the MPS dump but prior to APU shutdown; possibly opened momentarily during FCS checkout to position the SSME's for entry. All actuations require momentary power (250 ms). ANALYSIS USAGE:
50090100 MPS #1 SYS S/O VALVE	19	7677	None	Not used (momentary power)
50090200 MPS #2 SYS S/O VALVE	19	7677	None	Not used (momentary power)
50090300 MPS #3 SYS S/O VALVE	19	7677	None	Not used (momentary power)
50180 RUDDER/SPEED BRAKE ACTUATOR VALVE POSITIONS				FUNCTION: Provide indications of which hydraulic system is powering the control valve logic. USAGE: On during main hydraulic system operation.

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
50180100 RUD/SPBK SW VL ACT 1	1	7677	None	Not used (low power)
50180200 RUD/SPDBK SW VL PS 2	1	7677	None	Not used (low power)
50190 TVC ACTUATOR SWITCH VALVE POSITION				FUNCTION: Provide indications of which hydraulic system is powering each actuator. There are two indicators per actuator switching valve package. USAGE: On during main hydraulic system operation.
				ANALYSIS USAGE:
50190100 (2) ME 1 PITCH SW V ACTV	1	7677	None	Not used (low power)
50190200 ME 1 YAW SW ACTV	1	7677	None	Not used (low power)
50190300 ME 2 PITCH SW V ACTV	1	7677	None	Not used (low power)
50190400 ME 2 YAW SW V ACTV	1	7677	None	Not used (low power)
50190500 (2) ME 3 PITCH SW V ACTV	1	7677	None	Not used (low power)
50190600 ME 3 YAW SW V ACTV	1	7677	None	Not used (low power)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50200 ELEVON ACTUATOR SWITCH VALVE POSITION				FUNCTION: Provide indications of which hydraulic system is powering each actuator. There are two indicators per elevon switching valve package. USAGE: On during main hydraulic system operations. ANALYSIS USAGE:
50200100 ELV ACT SW V ACT-LO	1	7677	None	Not used (low power)
50200200 ELV ACT SW V PS2-LO	1	7677	None	Not used (low power)
50200300 ELV ACT SW V ACT-LI	1	7677	None	Not used (low power)
50200400 ELV ACT SW V PS2-LI	1	7677	None	Not used (low power)
50200500 ELV ACT SW V ACT-RI	1	7677	None	Not used (low power)
50200600 ELV ACT SW V PS2-RI	1	7677	None	Not used (low power)
50200700 ELV ACT SW V ACT-RO	1	7677	None	Not used (low power)
50200800 ELV ACT SW V PS2-RO	1	7677	None	Not used (low power)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50270 LANDING GEAR ISOLATION VALVES				FUNCTION: Isolate high-pressure hydraulics from the landing gear subsystem when closed. These are normally open, latched closed, solenoid valves, requiring momentary power to open or close (250 ms). USAGE: Closed when main hydraulic pumps are operating in the pressurized mode. Open on-orbit for circ pump operation. The systems are opened in reverse sequence on 5 min intervals starting with system 3 at 15 min prior to touchdown. All actuations require momentary power. ANALYSIS USAGE:
50270100 LG ISOL VLV SYS #1	19	7677	None	Not used (momentary power)
50270200 LG ISOL VLV SYS #2	19	7677	None	Not used (momentary power)
50270300 LG ISOL VLV SYS #3	19	7677	None	Not used (momentary power)
50280 LH2 UMBILICAL CONTROL VALVES				FUNCTION: Permit hydraulic retraction or extension of the ET/Orbiter LH2 Umbilical Actuators. USAGE:

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Retract actuators are GPC energized for 2 sec prior to door closure following ET separation.
				ANALYSIS USAGE:
50280100 LH2 UMB HYD ACT1-EXT	12	7677	None	Not used (GSE usage)
50280210 LH2 UMB HYD ACT1-RET	11	7677	None	Not used (momentary power)
50280300 LH2 UMB HYD ACT2-EXT	12	7677	None	Not used (GSE usage)
50280410 LH2 UMB HYD ACT2-RET	11	7677	None	Not used (momentary power)
50280500 LH2 UMB HYD ACT3-EXT	12	7677	None	Not used (GSE usage)
50280610 LH2 UMB HYD ACT3-RET	11	7677	None	Not used (momentary power)
50290 LO2 UMBILICAL CONTROL VALVES				FUNCTION:
				Permit hydraulic retraction or extension of the ET/Orbiter LO2 umbilical.
				USAGE:
				Retract actuators are GPC energized for 2 seconds prior to door closure following ET separation.
				ANALYSIS USAGE:
50290100 LO2 UMB HYD ACT1-EXT	12	7677	None	Not used (GSE usage)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50290210 LO2 UMB HYD ACT1-RET	11	7677	None	Not used (momentary power)
50290300 LO2 UMB HYD ACT2-EXT	12	7677	None	Not used (GSE usage)
50290410 LO2 UMB HYD ACT2-RET	11	7677	None	Not used (momentary power)
50290500 LO2 UMB HYD ACT3-EXT	12	7677	None	Not used (GSE usage)
50290610 LO2 UMB HYD ACT3-RET	11	7677	None	Not used (momentary power)
50330 H20 BOILER HYD H20 VALVES				FUNCTION: Control the water supply to the Boiler for cooling the hydraulic fluid. The valves are normally closed solenoid valves, operated by either the A or B H20 Boiler Controller in a pulsed mode, the frequency of which is a function of the hydraulic fluid outlet temperature. The valves will be closed when the Hydraulic Bypass Valves are in the bypass position or if the water level in the Boiler exceeds a maximum level, as determined by level sensors in the Boiler. The power listed for each of these items includes the valve and its associated logic when the valve is operated. USAGE: The valves will pulse from approx 15 min after APU startup until APU shutdown, and from approx 15 min after APU activation during entry through

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATT)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				the EOM. The pulse frequency is a function of the hydraulic fluid outlet temperature.
				ANALYSIS USAGE:
50330100 H20 BR1 HYD H20 CT A	30	7677	207,505,507	STS-1 - On with a usage factor of 50% from 10 min MET until APU shutdown at MECO + 5 min 20 sec, and from 15 min after APU activation at 3 min prior to deorbit until EOM STS-2 - Same as STS-1 OPS - On with a usage factor of 50% from 10 min MET until APU shutdown at MECO + 5 min 20 sec, and from 15 min after APU activation at 3 min prior to 400,000 ft until EOM
50330210 H20 BR1 HYD H20 CT B	29	7677	None	Not used (redundant power)
50330300 H20 BR2 HYD H20 CT A	25	7677	207,505,507	Same as 50330100
50330410 H20 BR2 HYD H20 CT B	31	7677	None	Not used (redundant power)
50330500 H20 BR3 HYD H20 CT A	24	7677	207,505,507	Same as 50330100
50330610 H20 BR3 HYD H20 CT B	30	7677	None	Not used (redundant power)
50340 H20 BOILER APU H20 VALVES				FUNCTION: Control the water supply to the Boiler for cooling the

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				APU lube oil. The valves are normally closed solenoid valves, operated by either the A or B H20 Boiler Controller in a pulsed mode, the frequency of which is a function of the APU lube oil outlet temperature. The power listed for each of these items includes the valve and its associated logic when the valves are operated.
				USAGE:
				The valve will pulse from approximately 6 min after APU startup until APU shutdown. The pulse frequency is a function of the APU lube oil outlet temperature.
				ANALYSIS USAGE:
50340100 H20 BR1 APU H20 CT A	30	7677	207,507	STS-1 - On with a usage factor of 10% from 1 min after lift-off until APU shutdown at MECO + 5 min, 20 sec, from 6 min after APU activation at 3 min prior to deorbit until 2 min after stoproll
				STS-2 - Same as STS-1
				OPS - On with a usage factor of 10% from 1 min after lift-off until APU shutdown at MECO + 5 min, 20 sec and from 6 min after APU activation at 3 min prior to 400,000 ft until 2 min after stoproll
50340210 H20 BR1 APU H20 CT B	29	7677	None	Not used (redundant power)
50340300 H20 BR2 APU H20 CT A	25	7677	207,507	Same as 50340100
50340410 H20 BR2 APU H20 CT B	31	7677	None	Not used (redundant equipment)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50340500 H20 BR3 APU H20 CT A	24	7677	207,507	Same as 50340100
50340610 H20 BR3 APU H20 CT B	30	7677	None	Not used (redundant equipment)
50350 WSB GN2 CONTROL VALVES				FUNCTION: Control the flow of gaseous nitrogen to the Water Tank for positive water expulsion. These are normally open valves, magnetically latched closed, requiring momentary power to open or close. Their operation is controlled by switches for either the A or B H20 Boiler Controller. The power listed for each of these items includes the valve and its associated logic when the valves are opened or closed. USAGE: Valve will be closed after APU shutdown, reopened prior to APU startup. Valve actuation time is 250 ms. ANALYSIS USAGE:
50350100 WSB #1 GN2 CTL VL A	42	7677	None	Not used (momentary power)
50350210 WSB #1 GN2 CTL VL B	42	7677	None	Not used (redundant equipment)
50350300 WSB #2 GN2 CTL VL A	41	7677	None	Not used (momentary power)
50350410 WSB #2 GN2 CTL VL B	41	7677	None	Not used (redundant equipment)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50350500 WSB #3 GN2 CTL VL A	42	7677	None	Not used (momentary power)
50350610 WSB #3 GN2 CTL VL B	42	7677	None	Not used (redundant equipment)
50360 WSB HYD BYPASS CNTL VALVES				FUNCTION: Provide a hydraulic fluid bypass around the H20 Boiler. The valves are operated by either the A or B H20 Boiler Controller based on fluid temperature. When the temperature is below 190 deg F the valves open to bypass, when above 210 deg F the valves close to bypass and open to permit hydraulic fluid circulation through the boiler. The valves are motor operated and require power only when the valve is moving. The power listed for each of these items includes the valve and its associated logic when the valves are operated. USAGE: In bypass until approx 15 min after APU startup then moves to boiler position until sometime after APU shutdown at MECO + 5 min when it returns to bypass. During descent the valve will be in the boiler position from approx 15 min after APU startup through the EOM. ANALYSIS USAGE:
50360100 WSB #1 HYD BYP CT A	22	7677	103,109	On for 50 sec at lift-off + 10 min; on for 50 sec at deorbit + 10 min
50360210 WSB #1 HYD BYP CT B	22	7677	None	Not used (redundant equipment)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50360300 WSB #2 HYD BYP CT A	21	7677	103,109	Same as 50360100
50360410 WSB #2 HYD BYP CT B	23	7677	None	Not used (redundant equipment)
50360500 WSB #3 HYD BYP CT A	21	7677	103,109	Same as 50360100
50360610 WSB #3 HYD BYP CT B	25	7677	None	Not used (redundant equipment)
50370 WSB CONTROL LOGIC				FUNCTION: Provides power for the 5 VDC transducers signal conditioner circuits, (except liquid level sensors) boiler heater control and power to both A and B H2O boiler controller logic. This power represents the power utilized when providing control but not cycling of the following components: H2O Boiler Hydraulic H2O valves (50330) H2O Boiler APU H2O valves (50340) WSB Hydraulic Bypass Control valves (50360) USAGE: One per system on continuously throughout all missions. During on-orbit coast periods all functions except tank and boiler heater control are inhibited. ANALYSIS USAGE:
50370100 WSB 1A CNTL LOG/SNSR	4	7677	101	On from pwr xfr int to EOM

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50370210 WSB 1B CNTL LOG/SNSR	4	7677	None	Not used (redundant equipment)
50370300 WSB 2A CNTL LOG/SNSR	3	7677	101	On from pwr xfr int to EOM
50370410 WSB 2B CNTL LOG/SNSR	4	7677	None	Not used (redundant equipment)
50370500 WSB 3A CNTL LOG/SNSR	3	7677	101	On from pwr xfr int to EOM
50370610 WSB 3B CNTL LOG/SNSR	4	7677	None	Not used (redundant equipment)
50380 WSB LIQ LEVEL SENSORS				FUNCTION: This represents the power utilized by the liquid level sensors and their associated signal conditioners when in operation. USAGE: One per system on continuously throughout all missions. ANALYSIS USAGE:
50380100 WSB 1A LIQ LVL SNSR	<1	7677	None	Not used (low power)
50380210 WSB 1B LIQ LVL SNSR	<1	7677	None	Not used (redundant equipment)
50380300 WSB 2A LIQ LVL SNSR	<1	7677	None	Not used (low power)

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50380410 WSB 2B LIQ LVL SNSR	<1	7677	None	Not used (redundant equipment)
50380500 WSB 3A LIQ LVL SNSR	<1	7677	None	Not used (low power)
50380610 WSB 3B LIQ LVL SNSR	<1	7677	None	Not used (redundant equipment)
50510 CIRCULATION MOTOR PUMPS				FUNCTION: Circulate hydraulic fluid during prelaunch, orbital coast, and post landing periods for thermal control purposes, and to provide accumulator recharge, as required. USAGE: Three pumps on during prelaunch from T-5 hrs to APU start + 4 sec. Normally controlled by the computer on orbit. The on time of each cycle is computer adjusted for each system in response to individual system temperature measurements, and is controlled so that only one pump is on at a time. Operation is enabled from 4.0 hrs after MECO until the pumps are turned off at the start of pre-deorbit checkout. Three pumps are on from the initiation of the "Landing Gear Release" command until the end of the mission. Thermostatically controlled, duty cycle is a function of attitude and beta angle. ANALYSIS USAGE:
50510'00 CIRC MOTOR PUMP #1	1944	7677	201,505, 600 series	On from pwr xfr int to L/O minus 5 min, from stop-roll plus 2 min 30 sec to EOM, see appendix B heater

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				tables for on-orbit usage
50510200 CIRC MOTOR PUMP #2	1944	7677	201,505, 600 series	On from pwr xfr int to L/O minus 5 min, from stoproll plus 2 min 30 sec to EOM, see appendix B heater tables for on-orbit usage
50510300 CIRC MOTOR PUMP #3	1944	7677	201,505, 600 series	On from pwr xfr int to L/O minus 5 min, from stoproll plus 2 min 30 sec to EOM, see appendix B heater tables for on-orbit usage
50520 ELEVON HTR BLANKETS				FUNCTION: Maintain the Elevon actuators above -40 deg F on-orbit. The A and B heaters are redundant. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A-12). Both systems A and B may be enabled simultaneously. For most missions only A or B will be enabled pre-launch. Duty cycles are a function of attitude and beta angle. ANALYSIS USAGE:
50520100 LI ELVON ACTR HTR A	88	7677	600 series	See appendix B heater tables
50520200 LI ELVON ACTR HTR B	88	7677	600 series	See appendix B heater tables
50520300 LO ELVON ACTR HTR A	89	7677	600 series	See appendix B heater tables

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50520400 LO ELVON ACTR HTR B	89	7677	600 series	See appendix B heater tables
50520500 RI ELVON ACTR HTR A	88	7677	600 series	See appendix B heater tables
50520600 RI ELVON ACTR HTR B	88	7677	600 series	See appendix B heater tables
50520700 RO ELVON ACTR HTR A	88	7677	600 series	See appendix B heater tables
50520800 RO ELVON ACTR HTR B	88	7677	600 series	See appendix B heater tables
50530 WSB TANK/BOILER HEATERS				FUNCTION: Prevent water freezing in the water tank and H20 Boiler during on-orbit operations. There are redundant heater elements which are operated by the redundant controllers. Both heaters are enabled from GSE sources until APU start at approx T-4 min. USAGE: Heaters are cycled by the H20 Boiler Controllers, (Ref 5380). Duty cycles are a function of attitude and beta angle, however, some usage may occur during ascent. ANALYSIS USAGE:
50530100 WSB TK/BOILER HTR 1A	159	7677	Asc, 600 series	See appendix B heater tables
50530210				

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
WSB TK/BOILER HTR 1B	162	7677	None	Not used (redundant equipment)
50530300 WSB TK/BOILER HTR 2A	155	7677	Asc, 600 series	See appendix B heater tables
50530410 WSB TK/BOILER HTR 2B	162	7677	None	Not used (redundant equipment)
50530500 WSB TK/BOILER HTR 3A	159	7677	Asc, 600 series	See appendix B heater tables
50530610 WSB TK/BOILER HTR 3B	162	7677	None	Not used (redundant equipment)
50540 WSB VENT NOZZ HTRS				FUNCTION: Prevent freezing and ice buildup in the H20 Boiler Steam Vent Nozzle. There are redundant elements in each heater, only one of which is used at a time. The heaters are enabled manually by the Boiler Controller Switch and controlled by a temperature sensor when enabled. Both heaters are enabled from GSE sources until APU start at approx T-4 min. USAGE: One in each system will cycle from some time prior to pwr xfr int until approximately 10 sec prior to APU shutdown and from 2 hrs prior to APU startup until APU shudown for FCS checkout or deorbit. Estimated duty cycle is 100%.
50540100				ANALYSIS USAGE:

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
WSB VENT NOZZ HTR 1A	74	7677	Asc,463,507	On from 2 hrs prior to APU startup for FCS checkout or deorbit until APU shutdown. See appendix B for ascent usage
50540210 WSB VENT NOZZ HTR 1B	75	7677	None	Not used (redundant equipment)
50540300 WSB VENT NOZZ HTR 2A	62	7677	Asc,507	On from 2 hrs prior to deorbit until APU shutdown. See appendix B for ascent usage
50540410 WSB VENT NOZZ HTR 2B	75	7677	None	Not used (redundant equipment)
50540500 WSB VENT NOZZ HTR 3A	59	7677	Asc,507	Same as 50540300
50540610 WSB VENT NOZZ HTR 3B	75	7677	None	Not used (redundant equipment)
50550 BODYFLAP PDU HEATERS				FUNCTION: Maintain the bodyflap power drive units above -40 deg F on-orbit. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A-12). Both systems A and B may be enabled simultaneously. For most missions only A or B will be enabled pre-launch. Duty cycles are a function of attitude and beta angle. ANALYSIS USAGE:
50550100				

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
BODYFLAP PDU HTR A	44	7677	600 series	See appendix B heaters tables
50550200 BODYFLAP PDU HTR B	44	7677	600 series	See appendix B heater tables
50560 RUDDER SPEEDBRAKE HEATER BLANKETS				FUNCTION: Maintain the Rudder/Speed Brake Power Drive Units above -40 deg F on-orbit. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A-12). Both systems A and B may be enabled simultaneously. For most missions only A or B will be enabled pre-launch. Duty cycles are a function of attitude and beta angle. ANALYSIS USAGE:
50560100 RUD SPBK HTR A	110	7677	600 series	See appendix B heater tables
50560200 RUD SPBK HTR B	110	7677	600 series	See appendix B heater tables
50700 BODYFLAP SEAL DRAIN LINE HEATERS				FUNCTION: Provide heat to warm the Body Flap Drain Line. USAGE: Heaters are thermostatically controlled but may be

TABLE A-XVII.- HYDRAULICS SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				enabled or disabled from the aft station (PNL A-12). Both systems A and B may be enabled simultaneously. For most missions only A or B will be enabled pre-launch. Duty cycles are a function of attitude and beta angle.
50700100 BDYFLAP A SCD LN HT1	7	7677	600 series	ANALYSIS USAGE: See appendix B heater tables
50700200 BDYFLAP A SCD LN HT2	7	7677	600 series	See appendix B heater tables
50700300 BDYFLAP B SCD LN HT1	2	7677	600 series	See appendix B heater tables
50700400 BDYFLAP B SCD LN HT2	2	7677	600 series	See appendix B heater tables
50710 RUDDER SPEED-BRAKE SEAL DRAIN LINE HTRS				FUNCTION: Provide heat to warm the Rudder/Speed Brake Drain Line. USAGE: Heaters are thermostatically controlled but may be enabled or disabled from the aft station (PNL A-12). Both systems A and B may be enabled simultaneously. For most missions only A or B will be enabled pre-launch. Duty cycles are a function of attitude and beta angle.
50710100 RD SPDBK SCD LN HT1	8	7677	600 series	ANALYSIS USAGE: See appendix B heater tables

TABLE A-XVII.- HYDRAULICS SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
50710200 RD SPDBK SCD LN HT2	8	7677	600 series	See appendix B heater tables

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51010 LH RMS				FUNCTION: Provides the capability to deploy payloads from the PLB and to grapple and stow payloads in the PLB. It may also be used for remote manipulation of payloads in the bay and as a TV platform for remote viewing of EVA and of payloads in the bay. There is a spotlight and a B&W TV camera on the manipulator arm. USAGE: Typical deployment usage includes: 5 min to move the arm from the stowed position and grapple a payload in the bay; 25 min to move the payload to the release position, release it, and move the arm to a holding position clear of the released payload; the arm is then held in position until the Orbiter separation maneuver is complete, and operated for 5 min to return the arm to the stowed position. Typical retrieval usage includes: 5 min to move the arm from the stowed to the capture position, 10-15 min with the arm held in position, while closing with the payload; 2 min to grapple the payload; 5-20 min to move the payload into the bay; then 5 min to return the arm to the stowed position. Note: Estimated joint motor usage is 50% while moving and 10% while holding position. ANALYSIS USAGE:
51010100 LH RMS - MOTORS	634	7637	011,451,453	STS-1 - N/A STS-2 - On with a usage factor of 57.5% during the RMS checkout.

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - During Payload Deployment: on with a usage factor of 50% for 30 min beginning at the initiation of deployment sequence, then on with a usage factor of 10% until completion of the Orbiter separation maneuver. During Payload Retrieval: on with a usage factor of 50% for 5 min beginning 20 min prior to capture, reduced to a usage factor of 10% for 15 min, then returned to a usage factor of 50% for 27 min
51010200 LH RMS - ELECTRONICS	211	7637	055,451,453	STS-1 - N/A STS-2 - On prior to and during RMS checkout OPS - During payload deployment: on from 30 min prior to payload release until completion of the Orbiter separation maneuver. During payload retrieval: on from 20 min prior to until 40 min after capture
51010310 LH RMS - B/U ELECT	60	7637	None	Not used (redundant equipment)
51020 MANIP CTL INT UNIT				FUNCTION: Provides signals from a GPC and the RMS controls to the manipulator arm for motion control, and signals from the arm to the GPC and the RMS displays for operator readout. USAGE: On whenever the arm is powered. ANALYSIS USAGE:

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51020000 MANIP CTL INT UNIT	150	7637	055,451,453	STS-1 - N/A STS-2 - On prior to and during RMS checkout OPS - During Payload Deployment: On from 30 min prior to payload release until initiation of the separation maneuver. During Payload Retrieval: On from 20 min prior to until 40 min after capture
51030 MANIP CNTL PANEL				FUNCTION: Provides the controls and displays necessary for RMS operation. The panel interfaces with the GPC and the arm, through the MCIU. USAGE: The primary control panels will normally be on whenever the arm is powered. The backup panel will be active when the arm is powered with the primary panels shut down. ANALYSIS USAGE:
51030100 MANIP CNTL PANEL-DC	5	7637	055,451,453	STS-1 - N/A STS-2 - On prior to and during RMS checkout. OPS - During Payload Deployment: On from 30 min prior to payload release until initiation of the separation maneuver. During Payload Retrieval: On from 20 min prior to until 40 min after capture
51030200 MANIP CNTL PANEL-AC	113	7637	055,451,453	STS-1 - N/A

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - Same as 51030100 OPS - Same as 51030100
51030310 MANIP CNTL PNL-B/UP	45	7637	None	Not used (redundant equipment)
51040 LH RMS POSITION MTRS				FUNCTION: Deploy the manipulator arm from the stowed to the operating position (outboard) and return it to the stowed position. The #1 and #2 motors are redundant but both are used together. USAGE: Both on for 40 sec to deploy the manipulator following PLB doors opening; both on for 40 sec to stow the manipulator just prior to PLB doors closing. A single motor at each location can deploy, or stow, the manipulator in 68 sec. Note: In general, the manipulator arm will be moved clear of the payload bay (i.e. to the outboard position) immediately after PLB door opening regardless of its planned usage, except for the initial RMS checkout on STS-2. ANALYSIS USAGE:
51040100 LH RMS POSIT MTR 1	70	7637	007,435,437	STS-1 - N/A STS-2 - On for 40 sec to deploy or stow the manipulator during RMS checkout.

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				OPS - On for 40 sec at 15 min after PLB Doors open initiation; on for 40 sec beginning 2 min 5 sec prior to PLB Doors close initiation
51040200 LH RMS POSIT MTR 2	70	7637	007,435,437	STS-1 - N/A STS-2 - Same as 51040100 OPS - Same as 51040100
51060 LH MANIP RETENTION LATCH ACTUATORS				FUNCTION: Operate the latches which retain the manipulator arm to the deployment/retention mechanism during boost and entry. The #1 and #2 actuators are redundant, but both are used together. USAGE: All on for 7.5 sec to unlatch prior to arm operation; all on for 7.5 sec to latch prior to stowing. A single actuator can operate the latch in 15 sec. ANALYSIS USAGE:
51050100 L MAN FWD RET LCH 1	60	7637	009,435,437	STS-1 - N/A STS-2 - On for 8 sec for each latch actuation during the RMS checkout. OPS - On for 8 sec to unlatch the manipulator arm beginning 14 min 30 sec after PLB door open initiation; on for 8 sec to latch the manipulator arm beginning 40 sec prior to PLB door close initiation

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51060200 L MAN FWD RET LCH 2	60	7637	009,435,437	STS-1 - N/A STS-2 - Same as 51060100 OPS - Same as 51060100
51060300 L MAN MID RET LCH 1	60	7637	009,435,437	STS-1 - N/A STS-2 - Same as 51060100 OPS - Same as 51060100
51060400 L MAN MID RET LCH 2	60	7637	009,435,437	STS-1 - N/A STS-2 - Same as 51060100 OPS - Same as 51060100
51060500 L MAN AFT RET LCH 1	60	7637	009,435,437	STS-1 - N/A STS-2 - Same as 51060100 OPS - Same as 51060100
51060600 L MAN AFT RET LCH 2	60	7637	009,435,437	STS-1 - N/A STS-2 - Same as 51060100 OPS - Same as 51060100
51070 PAYLOAD RETENTION				

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
LATCH DRIVE MOTORS				FUNCTION: Operate the latches which secure payloads along the longeron during boost and entry. The #1 and #2 motors are redundant, but both are used together. USAGE: On for 30 sec to latch or release a payload. The number of latches required is mission dependent. None are required for Spacelab. ANALYSIS USAGE:
51070100 PL RET LCH DR 1 MT 1	100	7617	451,453	STS-1 - N/A STS-2 - N/A OPS - On for 30 sec during payload deployment on satellite deployment missions; on for 30 sec during payload retrieval on satellite retrieval missions.
51070200 PL RET LCH DR 1 MT 2	100	7617	451,453	STS-1 - N/A STS-2 - N/A OPS - Same as 51070100
51070300 PL RET LCH DR 2 MT 1	100	7617	451,453	STS-1 - N/A STS-2 - N/A OPS - Same as 51070100

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51070400 PL RET LCH DR 2 MT 2	100	7617	451,453	STS-1 - N/A STS-2 - N/A OPS - Same as 51070100
51070500 PL RET LCH DR 3 MT 1	100	7617	451,453	STS-1 - N/A STS-2 - N/A OPS - Same as 51070100
51070600 PL RET LCH DR 3 MT 2	100	7617	451,453	STS-1 - N/A STS-2 - N/A OPS - Same as 51070100
51080 RENDEZVOUS SENSOR DEPLOY MOTORS				FUNCTION: Deploy the Ku-Band/Rendezvous Radar antenna to the operating position. The #1 and #2 motors are redundant, but both are used together. USAGE: Both on for 20 sec for antenna deployment and again for antenna stowing. Manually initiated by the crew. Deployment will be accomplished just after PLB doors opening. Stowing will be accomplished just prior to PLB doors closing. Deployment can be accomplished by one motor in 40 sec.

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
51080100 RDZ SNSR DPY DR MT 1	200	7600	435,437	OFT - N/A OPS - On for 20 sec beginning 6 min 55 sec after PLB doors open initiation; on for 20 sec beginning 5 sec after PLB doors close initiation.
51080200 RDZ SNSR DPY DR MT 2	200	7600	435,437	OFT - N/A OPS - Same as 51080100
51090 ET UMBILICAL DOOR DRIVE MOTORS				FUNCTION: Drive the ET umbilical doors closed following ET sep. The #1 and #2 motors are redundant, but both are used together. USAGE: All on for 24 sec to close the doors. Manually initiated by the crew, normally any time after insertion. For RTLS aborts, the doors will be automatically closed by the GPC. Each door can be closed by a single motor in 48 sec. Note: The sequence for closing the ET umbilical doors is: 1). Unlatch the center line latches, 2). Drive the doors closed, 3). Latch the doors closed. ANALYSIS USAGE:

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51090100 ET UMB LH D DR MTR 1	185	7677	211	On for 24 sec beginning 5 min 32 sec after insertion
51090200 ET UMB LH D DR MTR 2	185	7677	211	On for 24 sec beginning 5 min 32 sec after insertion
51090300 ET UMB RH D DR MTR 1	185	7677	211	On for 24 sec beginning 5 min 32 sec after insertion
51090400 ET UMB RH D DR MTR 2	185	7677	211	On for 24 sec beginning 5 min 32 sec after insertion
51100 ET UMBILICAL DOOR LATCH MOTORS				FUNCTION: Operate the latches which maintain the ET umbilical doors closed during entry. The #1 and #2 motors are redundant, but both are used together. USAGE: All on for 6 sec after the doors have been driven closed. The latches can be operated by a single motor in 12 sec. For an RTLS abort the latches are operated by the GPC ANALYSIS USAGE:
51100100 ET UMB LH D LCH MT 1	210	7677	211	On for 6 sec beginning 5 min 56 sec after insertion
51100200 ET UMB LH D LCH MT 2	210	7677	211	On for 6 sec beginning 5 min 56 sec after insertion
51100300 ET UMB RH D LCH MT 1	210	7677	211	On for 6 sec beginning 5 min 56 sec after insertion

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51100400 ET UMB RH D LCH MT 2	210	7677	211	On for 6 sec beginning 5 min 56 sec after insertion
51110 ET UMBILICAL DOOR CENTER LINE LATCH MOTORS				FUNCTION: Operate the center line latches which maintain the ET umbilical doors open during boost. The #1 and #2 motors are redundant, but both are used together. USAGE: All on for 6 sec to unlatch the doors prior to driving them closed. The latches can be operated by a single motor in 12 sec. ANALYSIS USAGE:
51110100 ET UMB CL LCH 1 MT 1	83	7677	211	On for 6 sec beginning 5 min 26 sec after insertion
51110200 ET UMB CL LCH 1 MT 2	83	7677	211	On for 6 sec beginning 5 min 26 sec after insertion
51110300 ET UMB CL LCH 2 MT 1	83	7677	211	On for 6 sec beginning 5 min 26 sec after insertion
51110400 ET UMB CL LCH 2 MT 2	83	7677	211	On for 6 sec beginning 5 min 26 sec after insertion
51510 LH MANIP HEATERS SYS #1				FUNCTION: Provide thermal protection for the RMS arm electronics. USAGE:

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Thermostatically controlled, duty cycle is a function of attitude and beta angle. Both are enabled whenever the PLB door is open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters. ANALYSIS USAGE:
51510100 LRMS SHDR PED HTR-1	36	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510200 LRMS SHDR YW LD HT-1	27	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510300 LRMS SHDR PH TO HT-1	19	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510400 LRMS SHDR EL TR HT-1	56	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51510500 LRMS ELB PH TOR HT-1	31	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510600 LRMS ELB EL TR HTR-1	56	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510700 LRMS WR FWD TR HTR-1	86	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510800 LRMS WR PH TOR HTR-1	24	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51510900 LRMS WR YW TOR HTR-1	14	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51511 LH MANIP HEATERS				FUNCTION:

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
SYS #1				Provide thermal protection for the RMS arm electronics. USAGE: Thermostatically controlled, duty cycle is a function of attitude and beta angle. Both are enabled whenever the PLB door is open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters. ANALYSIS USAGE:
51511100 LRMS WR ROLL EX HT-1	38	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51511200 LRMS WR ROLL EL HT-1	20	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51511300 LRMS END EFF #1 HT-1	48	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51511400 LRMS END EFF #2 HT-1	28	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610 LH MANIP HEATERS SYS #2				FUNCTION: Provide redundant thermal protection for the RMS arm electronics. USAGE: Thermostatically controlled, duty cycle is a function of attitude and beta angle. Both are enabled whenever the PLB door is open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters. ANALYSIS USAGE:
51610100 LRMS SHDR PED HTR-2	36	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610200 LRMS SHDR YW LD HT-2	27	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
51610300 LRMS SHDR PH TO HT-2	19	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610400 LRMS SHDR EL TR HT-2	56	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610500 LRMS ELB PH TOR HT-2	31	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610600 LRMS ELB EL TR HTR-2	56	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610700 LRMS WR FWD TR HTR-2	86	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51610800 LRMS WR PH TOR HTR-2	24	7637	600 series	STS-1 - N/A

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - See appendix B OPS - See appendix B
51610900 LRMS WR YW TOR HTR-2	14	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51611 LH MANIP HEATERS SYS #2				FUNCTION: Provides redundant thermal protection for the RMS arm electronics. USAGE: Thermostatically controlled, duty cycle is a function of attitude and beta angle. Both are enabled whenever the PLB door is open. Note: The expected worst case thermal environment will result in a duty cycle of approximately 50% on both heaters. ANALYSIS USAGE:
51611100 LRMS WR ROLL EX HT-2	38	7637	600 series	STS-1 - N/A STS-2 - See appendix B OPS - See appendix B
51611200 LRMS WR ROLL EL HT-2	20	7637	600 series	STS-1 - N/A

TABLE A-XVIII.- DOCKING AND CARGO HANDLING SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - See appendix B
				OPS - See appendix B
51611300 LRMS END EFF #1 HT-2	48	7637	600 series	STS-1 - N/A
				STS-2 - See appendix B
				OPS - See appendix B
51611400 LRMS END EFF #2 HT-2	28	7637	600 series	STS-1 - N/A
				STS-2 - See appendix B
				OPS - See appendix B

A-XIX 5200
MECH/LAND

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52010 RUDDER ACT ISO VLVS				FUNCTION: Bypass the individual secondary actuator ports if channel failure occurs. USAGE: Not used unless a channel failure occurs, then on continuously. ANALYSIS USAGE:
52010100 RUDDER ACT ISO VLV 1	15	7677	None	Not used (contingency equipment)
52010200 RUDDER ACT ISO VLV 2	15	7677	None	Not used (contingency equipment)
52010300 RUDDER ACT ISO VLV 3	15	7677	None	Not used (contingency equipment)
52010400 RUDDER ACT ISO VLV 4	15	7677	None	Not used (contingency equipment)
52020 LO ELVON ACT ISO V'S				FUNCTION: Same as 52010. USAGE: Same as 52010. ANALYSIS USAGE:
52020100 LO ELVON ACT ISO V 1	15	7677	None	Not used (contingency equipment)

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52020200 LO ELVON ACT ISO V 2	15	7677	None	Not used (contingency equipment)
52020300 LO ELVON ACT ISO V 3	15	7677	None	Not used (contingency equipment)
52020400 LO ELVON ACT ISO V 4	15	7677	None	Not used (contingency equipment)
52030 LI ELVON ACT ISO V'S				FUNCTION: Bypass the individual secondary actuator ports if channel failure occurs. USAGE: Not used unless a channel failure occurs, then on continuously. ANALYSIS USAGE:
52030100 LI ELVON ACT ISO V 1	15	7677	None	Not used (contingency equipment)
52030200 LI ELVON ACT ISO V 2	15	7677	None	Not used (contingency equipment)
52030300 LI ELVON ACT ISO V 3	15	7677	None	Not used (contingency equipment)
52030400 LI ELVON ACT ISO V 4	15	7677	None	Not used (contingency equipment)
52040 RI ELVON ACT ISO V'S				FUNCTION: Same as 52030.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Same as 52030.
				ANALYSIS USAGE:
52040100 RI ELVON ACT ISO V 1	15	7677	None	Not used (contingency equipment)
52040200 RI ELVON ACT ISO V 2	15	7677	None	Not used (contingency equipment)
52040300 RI ELVON ACT ISO V 3	15	7677	None	Not used (contingency equipment)
52040400 RI ELVON ACT ISO V 4	15	7677	None	Not used (contingency equipment)
52050 RO ELVON ACT ISO V'S				FUNCTION:
				Same as 52030.
				USAGE:
				Same as 52030.
				ANALYSIS USAGE:
52050100 RO ELVON ACT ISO V 1	15	7677	None	Not used (contingency equipment)
52050200 RO ELVON ACT ISO V 2	15	7677	None	Not used (contingency equipment)
52050300 RO ELVON ACT ISO V 3	15	7677	None	Not used (contingency equipment)
52050400				

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
RO ELVON ACT ISO V 4	15	7677	None	Not used (contingency equipment)
52060 BODYFLAP ACT ISO V'S				FUNCTION: Controls the hydraulic flow to the body flap motors when the body flap is commanded up or down. USAGE: Body flap is active for approximately 2 min during FCS aerosurface drive test, and from entry to touchdown. ANALYSIS USAGE:
52060100 BODYFLAP ACT ISO V 1	15	7677	503	On from entry (400 k ft) to stoproll
52060200 BODYFLAP ACT ISO V 2	15	7677	503	On from entry (400 k ft) to stoproll
52060300 BODYFLAP ACT ISO V 3	15	7677	503	On from entry (400 k ft) to stoproll
52070 SPD BRKE ACT ISO V'S				FUNCTION: Bypass the individual secondary actuator parts if channel failure occurs. USAGE: Not used unless a channel failure occurs, then on continuously. ANALYSIS USAGE:
52070100 SPD BRKE ACT ISO V 1	15	7677	None	Not used (contingency equipment)

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52070200 SPD BRKE ACT ISO V 2	15	7677	None	Not used (contingency equipment)
52070300 SPD BRKE ACT ISO V 3	15	7677	None	Not used (contingency equipment)
52070400 SPD BRKE ACT ISO V 4	15	7677	None	Not used (contingency equipment)
52100 STAR TRCKR DR MTRS				FUNCTION: Drive the two Startracker Doors open and closed. The #1 and #2 motors are redundant, but both are used together. USAGE: All on for 1 min, to open the door, just following OMS-2. All on for 1 min, to close the door, just prior to deorbit. The doors can be operated by a single motor in 2 min. ANALYSIS USAGE:
52100100 STTRKR DR MTR 1 (-Y)	33	7677	401,433	STS-1 - On for 1 min, 30 min after OMS-2 and for 1 min, 1.5 hrs prior to both the rehearsal deorbit and deorbit. STS-2 - On for 1 min, 30 min after OMS-2 and for 1 min , 1.5 hrs prior to deorbit. OPS - On for 1 min, 30 min after OMS-2 and for 1 min, 30 min prior to deorbit.
52100200				

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
STTRKR DR MTR 2 (-Y)	33	7677	401,433	Same as 52100100
52100300 STTRKR DR MTR 1 (-Z)	33	7677	401,433	Same as 52100100
52100400 STTRKR DR MTR 2 (-Z)	33	7677	401,433	Same as 52100100
52160 PLB LH DOOR DRV MTRS				FUNCTION: Drive the left hand PLB Door open and closed. The two motors are redundant, but both are used together. USAGE: Nominal - Both on for 63 sec following left hand door latch release when opening. Both on for 63 sec to initiate the door closing sequence. The PLB Doors are normally opened just after OMS-2 and closed just prior to deorbit. The doors can be operated by a single motor in 126 sec. STS-1 - The PLB Doors are operated in accordance with FTO's 151-01, 151-02, and 151-03 after OMS-2. In addition, they are closed and re-opened during the deorbit rehearsal and closed at deorbit per the nominal usage. STS-2 - Some minor variations from the PLB door checkout sequence for STS-1 is expected for STS-2. However, for analysis purposes, the same FTO sequences listed for STS-1 will be used for DTO 251, Payload Bay Door Performance, on STS-2. Notes: (1) The normal opening sequence is: 1) Unlatch middle centerline latches,

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				2) Unlatch fwd and aft centerline latches, 3) Unlatch right bulkhead latches, 4) Open right door, 5) Unlatch left bulkhead latches, 6) Open left door. The normal closing sequence is the reverse of the above.
				(2) The FTO 151-01 sequence is: 1) Unlatch and then relatch centerline latches 5-8, 2) Unlatch and then relatch centerline latches 9-12, 3) Unlatch and then relatch centerline latches 1-4, 4) Unlatch and then relatch centerline 13-16, 5) Unlatch and then relatch right forward bulkhead latches, 6) Unlatch and then relatch right aft bulkhead latches, 7) Unlatch and then relatch left forward bulkhead latches, 8) Unlatch and then relatch left aft bulkhead latches.
				(3) The FTO 151-02 sequence is: 1) Unlatch centerline latches 5-8 and 9-12, 2) Unlatch centerline latches 1-4 and 13-16, 3) Unlatch right forward and aft bulkhead latches, 4) Open right door, 5) COAS sighting and photograph of left door, 6) Close right door, 7) Latch right forward and aft bulkhead latches, 8) Latch centerline latches 1-4 and 13-16, 9) Latch centerline latches 5-8 and 9-12, 10) Unlatch and open both doors per the normal opening sequence, 11) Close left door, 12) Latch left forward and aft bulkhead latches, 13) COAS sighting and photograph of left door, 14) Unlatch left forward and aft bulkhead latches, 15) Open left door.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				(4) The FTO 151-03 sequence is : 1) Unlatch port and starboard radiator panel latches simultaneously , 2) Deploy port and starboard radiators simultaneously.
				ANALYSIS USAGE:
52160100 PLB LH DOOR DRV MTR1	400	7677	003,435 437	STS-1 - On for 63 sec during FTO 151-02; on for 63 sec beginning 2 min 44 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 63 sec beginning 3 min 33 sec after PLB Doors open initiation after deorbit rehearsal; on for 63 sec beginning 2 min 44 sec after PLB Doors close initiation at deorbit. STS-2 - On for 63 sec during FTO 1512-02; on for 63 sec beginning 2 min 44 sec after PLB Doors close initiation at deorbit. OPS - On for 63 sec beginning 3 min 33 sec after PLB Doors open initiation; on for 63 sec beginning 2 min 44 sec after Doors close initiation.
52160200 PLB LH DOOR DRV MTR2	400	7677	003,435,437,	Same as 52160100
52170 PLB RH DOOR DRV MTRS				FUNCTION: Drive the right hand PLB Door open and closed. The two motors are redundant but both are used together. USAGE: Nominal - Both on for 63 sec following right hand door latch release when opening. Both on for 63

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				sec following left hand door latch when closing. The PLB Doors are normally opened just after OMS-2 and closed just prior to deorbit. The doors can be operated by a single motor in 126 sec. STS-1 - The PLB Doors are operated in accordance with FTO's 151-01, 151-02, and 151-03 after OMS-2. In addition, they are closed and reopened during the deorbit rehearsal and closed at deorbit per the nominal usage. STS-2 - Some minor variations from the PLB door checkout sequence for STS-1 is expected for STS-2. However, for analysis purposes, the same FTD sequences listed for STS-1 will be used for DTO 251, payload bay door performance, on STS-2. Note: See 52160 for additional sequencing information.
				ANALYSIS USAGE:
52170100 PLB RH DOOR DRV MTR1	400	7677	003,435,437	STS-1 - On for 63 sec during FTO 151-02, on for 63 sec beginning 4 min 37 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 63 sec beginning 1 min 40 sec after PLB Doors open initiation after deorbit rehearsal; on for 63 sec beginning 4 min 37 sec after PLB Doors close initiation at deorbit. STS-2 - On for 63 sec during FTO 151-02, on for 63 sec beginning 4 min 37 sec after PLB Doors close initiation at deorbit. OPS - On for 63 sec beginning 1 min 40 sec after PLB Doors open initiation; on for 63 sec beginning 4 min 37 sec after PLB Doors close initiation at deorbit.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52170200 PLB RH DOOR DRV MTR2	400	7677	003,435,437	Same as 52170100
52180 AIR DATA PROBE ACTUATORS - LH				FUNCTION: Deploy the left Air Data Probe during descent. The two actuators are redundant, but both are used together. USAGE: Both on for 15 sec beginning at approx 100 kft during descent. Manually initiated by the crew. Deployment of the probe can be accomplished by a single actuator in 30 sec.
52180100 AIRDATA PRB ACT LH1	33	7677	509	ANALYSIS USAGE: On for 15 sec at approx 100 kft during descent
52180200 AIRDATA PRB ACT LH2	33	7677	509	On for 15 sec at approx 100 kft during descent Note: Exact on time is 7 min 3 sec prior to TD.
52200 AIR DATA PROBE ACTUATORS-RH				FUNCTION: Deploy the right Air Data Probe during descent. The two actuators are redundant, but both are used together. USAGE: Both on for 15 sec beginning at approx 100 kft during descent. Manually initiated by the crew. Deployment of the probe can be accomplished by a single actuator

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				in 30 sec.
				ANALYSIS USAGE:
52200100 AIRDATA PRB ACT RH1	33	7677	509	On for 15 sec at approx 100 kft during descent.
52200200 AIRDATA PRB ACT RH2	33	7677	509	On for 15 sec at approx 100 kft during descent. Note: Exact on time is 7 min 3 sec prior to TD.
52260 NOSE WHEEL STEER UNT				FUNCTION: Enables steering via the nosewheel below approx 115 knots during rollout. Above 115 knots rudder steering is normally used since nosewheel steering is ineffective. The pilot has the capability to override the lockout and utilize nosewheel steering above 115 knots after the nosewheel touches down.
				USAGE: On from approx 115 knots during rollout until after stoproll.
				ANALYSIS USAGE:
52260000 NOSE WHEEL STEER UNT	39	7677	509	On from TD until stoproll plus 6 min 30 sec.
52270 BRAKE/SKID PWR UNITS				FUNCTION: Enable braking after nosewheel touchdown and control hydraulic pressure to prevent skidding (with the antiskid switch on).

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Both on from launch through OMS-2 and from pre-deorbit checkout until deactivated by the crew after stoproll. Active for approx 20 - 30 sec (approximately half of the one min rollout).
				ANALYSIS USAGE:
52270100 BRK/SKID CNTL BOX A	19	7677	051,103,109, 401,433	STS-1 - On from pwr xfr int to OMS-2 plus 2 hrs 45 min from 6.0 hrs prior to until 30 min after rehearsal deorbit, and from 6.0 hrs prior to deorbit until EOM.
				STS-2 - On from pwr xfr int to OMS-2 plus 2 hrs 45 min, and from 6.0 hrs prior to deorbit until EOM.
				OPS - On from pwr xfr int to OMS-2 plus 30 min and from 3.0 hrs prior to deorbit until EOM.
52270200 BRK/SKID CNTL BOX B	19	7677	051,103,109, 401,433	Same as 52270100
52280 VENT DOORS FWD				FUNCTION:
				Operate the vents in the forward RCS and forward fuselage plenum compartments. The two motors in each set are redundant, but both are used together.
				USAGE:
				All on for 5 sec for each vent actuation. Open 15 sec prior to L/O, close just prior to deorbit, open at 2400 fps during descent, and move to the purge position at TD. The vents can be actuated by a single

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				motor in 10 sec. The opening and closing times are staggered in groups to prevent unnecessary load spikes on their respective buses.
				ANALYSIS USAGE:
52280100 VNT DR L 1/2 OP MT-1	45	7677	051,201,509	STS-1 - On for 5 sec, beginning at the following times: L/O minus 15 sec, 10 min after rehearsal deorbit TIG, and 5 min 5 sec prior to TD. STS-2 - On for 5 sec, beginning at the following times: L/O minus 15 sec, and 5 min 5 sec prior to TD. OPS - On for 5 sec, beginning at the following times: L/O minus 15 sec, and 5 min 5 sec prior to TD.
52280110 VNT DR L 1/2 CL MT-1	33	7677	433,509	STS-1 - On for 5 sec beginning at the following times: 6 hrs prior to the rehearsal deorbit, 6 hrs prior to deorbit, and touchdown. STS-2 - On for 5 sec beginning at the following times: 6 hrs prior to deorbit, and touchdown. OPS - On for 5 sec beginning at the following times: 30 min prior to deorbit, and touchdown.
52280200 VNT DR L 1/2 OP MT-2	44	7677	051,201,509	Same as 52280100
52280210 VNT DR L 1/2 CL MT-2	24	7677	433,509	Same as 52280110
52280300 VNT DR R 1/2 OP MT-1	45	7677	051,201,509	Same as 52280100

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52280310 VNT DR R 1/2 CL MT-1	33	7677	433,509	Same as 52280110
52280400 VNT DR R 1/2 OP MT-2	44	7677	051,201,509	Same as 52280100
52280410 VNT DR R 1/2 CL MT-2	24	7677	433,509	Same as 52280110
52290 VENT DOORS MID 3				FUNCTION: Operate the #3 vents in the PLB and lower mid-fuselage compartment. The two motors in each set are redundant, but both are used together. USAGE: All on for 5 sec for each vent actuation. Open 30 sec prior to L/O, close just prior to deorbit, open at 2400 fps during descent, and close at TD. The vents can be actuated by a single motor in 10 sec. The opening and closing times are staggered in groups to prevent unnecessary load spikes on their respective buses. ANALYSIS USAGE:
52290100 VNT DR L 3 OPEN MT-1	93	7677	051,201,509	STS-1 - On for 5 sec, beginning at the following times: 30 sec prior to L/O, 10 min 5 sec after rehearsal deorbit TIG, 5 min 6.5 sec prior to TD. STS-2 - On for 5 sec, beginning at the following times: 30 sec prior to L/O, and 5 min 6.5 sec prior to TD. OPS - On for 5 sec, beginning at the following times:

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				30 sec prior to L/O, 5 min 6.5 sec prior to TD.
52290110 VNT DR L 3 CLOS MT-1	45	7677	433,509	STS-1 - On for 5 sec beginning at the following times: 6 hrs 5 sec prior to the rehearsal deorbit, 6 hrs 5 sec prior to deorbit, and touchdown. STS-2 - On for 5 sec beginning at the following times: 6 hrs 5 sec prior to deorbit, and touchdown. OPS - On for 5 sec beginning at the following times: 30 min 5 sec prior to deorbit, and touchdown.
52290200 VNT DR L 3 OPEN MT-2	102	7677	051,201,509	Same as 52290100
52290210 VNT DR L 3 CLOS MT-2	51	7677	433,509	Same as 52290110
52290300 VNT DR R 3 OPEN MT-1	93	7677	051,201,509	Same as 52290100
52290310 VNT DR R 3 CLOS MT-1	45	7677	433,509	Same as 52290110
52290400 VNT DR R 3 OPEN MT-2	102	7677	051,201,509	Same as 52290100
52290410 VNT DR R 3 CLOS MT-2	51	7677	433,509	Same as 52290110
52300 VENT DOORS MID 5				FUNCTION: Operate the #5 vents in the PLB and lower mid-fuselage compartment. The two motors in each set are redundant, but both are used together.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				All on for 5 sec for each vent actuation. Open 20 sec prior to L/O, close just prior to deorbit, open at 2400 fps during descent, and close at TD. The vents can be actuated by a single motor in 10 sec. The opening and closing times are staggered in groups to prevent unnecessary load spikes on their respective buses.
				ANALYSIS USAGE:
52300100 VNT DR L 5 OPEN MT-1	93	7677	051,201,509	STS-1 - On for 5 sec, beginning at the following times: 20 sec prior to L/O, 10 min 10 sec after rehearsal deorbit TIG, 5 min 5.5 sec prior to TD. STS-2 - On for 5 sec beginning at the following times: 20 sec prior to L/O, and 5 min 5.5 sec prior to TD. OPS - On for 5 sec, beginning at the following times: 20 sec prior to L/O, 5 min 5.5 sec prior to TD.
52300110 VNT DR L 5 CLOS MT-1	45	7677	433,509	STS-1 - On for 5 sec beginning at the following times: 6 hrs 10 sec prior to rehearsal deorbit; 6 hrs 10 sec prior to deorbit; and touchdown. STS-2 - On for 5 sec beginning at the following times: 6 hrs 10 sec prior to deorbit; and touchdown. OPS - On for 5 sec beginning at the following times: 30 min 10 sec prior to deorbit; and touchdown.
52300200 VNT DR L 5 OPEN MT-2	102	7677	051,201,509	Same as 52300100
52300210				

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
VNT DR L 5 CLOS MT-2	51	7677	433,509	Same as 52300110
52300300 VNT DR R 5 OPEN MT-1	93	7677	051,201,509	Same as 52300100
52300310 VNT DR R 5 CLOS MT-1	45	7677	433,509	Same as 52300110
52300400 VNT DR R 5 OPEN MT-2	102	7677	051,201,509	Same as 52300100
52300410 VNT DR R 5 CLOS MT-2	51	7677	433,509	Same as 52300110
52310 VENT DOORS MID 4/7				FUNCTION: Operate the #4 vents in the PLB and lower mid-fuselage compartment and the vents in the wing compartments. The two motors in each set are redundant, but both are used together. USAGE: All on for 5 sec for each vent actuation. Open 35 sec prior to L/O, close just prior to deorbit, open at 2400 fps during descent, and close at TD. The vents can be actuated by a single motor in 10 sec. The opening and closing times are staggered in groups to prevent unnecessary load spikes on their respective buses. ANALYSIS USAGE:
52310100 VNT DR L 4/7 OP MT-1	100	7677	051,201,509	STS-1 - On for 5 sec, beginning at the following times: 35 sec prior to L/O, 10 min 15 sec after rehearsal deorbit TIG, 5 min 7 sec prior to TD.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - On for 5 sec beginning at the following times: 35 sec prior to L/O, and 5 min 7 sec prior to TD. OPS - On for 5 sec, beginning at the following times: 35 sec prior to L/O, 5 min 7 sec prior to TD.
52310110 VNT DR L 4/7 CL MT-1	72	7677	433,509	STS-1 - On for 5 sec beginning at the following times: 6 hrs 15 sec prior to rehearsal deorbit, 6 hrs 15 sec prior to deorbit, and touchdown. STS-2 - On for 5 sec beginning at the following times: 6 hrs 15 sec prior to deorbit, and touchdown. OPS - On for 5 sec beginning at the following times: 30 min 15 sec prior to deorbit, and touchdown.
52310200 VNT DR L 4/7 OP MT-2	95	7677	051,201,509	Same as 52310100
52310210 VNT DR L 4/7 CL MT-2	68	7677	433,509	Same as 52310110
52310300 VNT DR R 4/7 OP MT-1	114	7677	051,201,509	Same as 52310100
52310310 VNT DR R 4/7 CL MT-1	44	7677	433,509	Same as 52310110
52310400 VNT DR R 4/7 OP MT-2	108	7677	051,201,509	Same as 52310100
52310410 VNT DR R 4/7 CL MT-2	45	7677	433,509	Same as 52310110

52320

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
VENT DOORS MID 6				FUNCTION: Operate the #6 vents in the PLB and lower mid-fuselage compartment. The two motors in each set are redundant, but both are used together. USAGE: All on for 5 sec for each vent actuation. Open 25 sec prior to L/O, close just prior to deorbit, open at 2400 fps during descent, and move either to closed or purge position at TD. The vents can be actuated by a single motor in 10 sec. The opening and closing times are staggered in groups to prevent unnecessary load spikes on their respective buses. ANALYSIS USAGE:
52320100 VNT DR L 6 OPEN MT-1	90	7677	051,201,509	STS-1 - On for 5 sec, beginning at the following times: 25 sec prior to L/O, 10 min 20 sec after rehearsal deorbit TIG, 5 min 6 sec prior to TD. STS-2 - On for 5 sec beginning at the following times: 25 sec prior to L/O and 5 min 6 sec prior to TD. OPS - On for 5 sec, beginning at the following times: 25 sec prior to L/O, 5 min 6 sec prior to TD.
52320110 VNT DR L 6 CLOS MT-1	42	7677	433,509	STS-1 - On for 5 sec beginning at the following times: 6 hrs 20 sec prior to rehearsal deorbit, 5 hrs 20 sec prior to deorbit, and touchdown. STS-2 - On for 5 sec beginning at the following times: 6 hrs 20 sec prior to deorbit, and touchdown. OPS - On for 5 sec beginning at the following times:

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				30 min 20 sec prior to deorbit, and touchdown.
52320200 VNT DR L 6 OPEN MT-2	92	7677	051,201,509	Same as 52320100
52320210 VNT DR L 6 CLOS MT-2	46	7677	433,509	Same as 52320110
52320300 VNT DR R 6 OPEN MT-1	90	7677	051,201,509	Same as 52320100
52320310 VNT DR R 6 CLOS MT-1	42	7677	433,509	Same as 52320110
52320400 VNT DR R 6 OPEN MT-2	92	7677	051,201,509	Same as 52320100
52320410 VNT DR R 6 CLOS MT-2	46	7677	433,509	Same as 52320110
52330 VENT DOORS AFT				FUNCTION: Operate the vents in the OMS pods and aft fuselage compartments. The two motors in each set are redundant, but both are used together. USAGE: All on for 5 sec for each vent actuation. Open 10 sec prior to L/O; closed just prior to deorbit; open at V_{REL} = 2400 fps during descent; purge position at TD. The vents can be actuated by a single motor in 10 sec. The opening and closing times are staggered in groups to prevent unnecessary load spikes on their respective buses.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
52330100 VNT DR L 8/9 OP MT-1	105	7677	051,201,509,	STS-1 - On for 5 sec, beginning at the following times: L/O minus 10 sec, 10 min 25 sec after rehearsal deorbit TIG, 5 min 4.5 sec prior to TD. STS-2 - On for 5 sec beginning at the following times: L/O minus 10 sec, 5 min 4.5 sec prior to TD. OPS - On for 5 sec beginning at the following times: L/O minus 10 sec, 5 min 4.5 sec prior to TD.
52330110 VNT DR L 8/9 CL MT-1	62	7677	433,509	STS-1 - On for 5 sec beginning at the following times: 6 hrs 25 sec prior to rehearsal deorbit, 6 hrs 25 sec prior to deorbit, and touchdown. STS-2 - On for 5 sec beginning at the following times: 6 hrs 25 sec prior to deorbit, and touchdown. OPS - On for 5 sec beginning at the following times: 30 min 25 sec prior to deorbit, and touchdown.
52330200 VNT DR L 8/9 OP MT-2	105	7677	051,201,509	Same as 52330100
52330210 VNT DR L 8/9 CL MT-2	60	7677	433,509	Same as 52330110
52330300 VNT DR R 8/9 OP MT-1	107	7677	051,201,509	Same as 52330100
52330310 VNT DR R 8/9 CL MT-1	54	7677	433,509	Same as 52330110
52330400 VNT DR R 8/9 OP MT-2	114	7677	051,201,509	Same as 52330100

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52330410 VNT DR R 8/9 CL MT-2	56	7677	433,509	Same as 52330110
52360 PBD BLKHD LCH MTRS				FUNCTION: Drive the PLB Door Bulkhead Latches open to allow door opening on-orbit; drive the latches closed prior to deorbit to maintain structural integrity during entry. The two motors in each set are redundant, but both are used together. USAGE: Nominal - On for 30 sec to latch or unlatch the PLB Doors. The right forward and right aft operate together after centerline latch release and prior to right door opening. The left forward and left aft operate together after right door opening and prior to left door opening. The closing sequence is the reverse of the above. Normally opened just after OMS-2 and closed just prior to deorbit. The latches can be operated by a single motor in 60 sec. STS-1 - The PLB Doors are operated in accordance with FTO's 151-01, 151-02, and 151-03 after OMS-2. In addition, they are closed and re-opened during the deorbit rehearsal and closed at deorbit per the nominal usage. STS-2 - Some minor variations from the PLB door checkout sequence for STS-1 is expected for STS-2. However, for analysis purposes, the same FTO sequences listed for STS-1 will be used for DTO

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				251, Payload Bay Door Performance, on STS-2. Note: See 52160 for additional sequencing information. ANALYSIS USAGE:
52360100 PBD LH FD BKHD LCH 1	169	7677	001,003,435, 437	STS-1 - On for 30 sec during each cycle required by FTO's 151-01, and 151-02; on for 30 sec beginning 3 min 57 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 30 sec beginning 2 min 53 sec after PLB Doors open initiation after deorbit rehearsal; on for 30 sec beginning 3 min 57 sec after PLB Doors close initiation at deorbit. STS-2 - On for 30 sec during each cycle required by FTO's 151-01, and 151-02; on for 30 sec beginning 3 min 57 sec after PLB Doors close initiation at deorbit. OPS - On for 30 sec during the PLB Doors opening sequence beginning at 2 min 53 sec after initiation; on for 30 sec during the PLB Doors closing sequence beginning at 3 min 57 sec after initiation
52360200 PBD LH FD BKHD LCH 2	169	7677	001,003,435, 437	Same as 52360100
52360300 PBD RH FD BKHD LCH 1	169	7677	001,003,435, 437	STS-1 - On for 30 sec during each cycle required by FTO's 151-01, and 151-02; on for 30 sec beginning 5 min 50 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 30 sec beginning 2 min after PLB Doors open initiation after deorbit rehearsal; on for 30 sec beginning 5 min 50 sec after PLB Doors close initiation at deorbit.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - On for 30 sec during each cycle required by FTO's 151-01, and 151-02; on for 30 sec beginning 5 min 50 sec after PLB Doors close initiation at deorbit. OPS - On for 30 sec during the PLB Doors opening sequence beginning at 1 min after initiation; on for 30 sec during the PLB Doors closing sequence beginning at 5 min 50 sec after initiation.
52360400 PBD RH FD BKHD LCH 2	169	7677	001,003,435, 437	Same as 52360300
52360500 PBD LH AF BKHD LCH 1	169	7677	001,003,435, 437	Same as 52360100
52360600 PBD LH AF BKHD LCH 2	169	7677	001,003,435, 437	Same as 52360100
52360700 PBD RH AF BKHD LCH 1	169	7677	001,003,435, 437	Same as 52360300
52360800 PBD RH AF BKHD LCH 2	169	7677	001,003,435. 437	Same as 52360300
52370 PBD CTR LN LCH MTRS				FUNCTION: Drive the PLB Door Center Line Latches open to allow door opening on-orbit; drive the latches closed prior to deorbit to maintain structural integrity during entry. The two motors in each set are redundant,

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				but both are used together.
				USAGE:
				Nominal - On for 20 sec to latch or unlatch the PLB Doors. The two middle latches are operated together to initiate the door opening sequence. The fwd and aft are then operated together prior to right bulkhead latch release. The closing sequence is the reverse of the above. The PLB Doors are normally opened just after OMS-2 and closed just prior to deorbit. The latches can be operated by a single motor in 40 sec.
				STS-1 - The PLB Doors are operated in accordance with FTO's 151-01, 151-02, and 151-03 after OMS-2. In addition, they are closed and re-opened during the deorbit rehearsal and closed at deorbit per the nominal usage.
				STS-2 - Some minor variations from the PLB door check-out sequence for STS-1 is expected for STS-2. However, for analysis purposes, the same FTO sequences listed for STS-1 will be used for DTO 251, Payload Bay Door Performance, on STS-2.
				Note: See 52160 for additional sequencing information.
				ANALYSIS USAGE:
52370100 PBD CTRLN LCH1-4 MT1	150	7677	001,003,435, 437	STS-1 - On for 20 sec during each cycle required by FTO's 151-01, and 151-02; on for 20 sec at 6 min 30 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 20 sec at 30 sec after PLB Doors open initiation after deorbit rehearsal; on for 20 sec at 6 min 30 sec after PLB Doors close initiation at deorbit.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				STS-2 - On for 20 sec during each cycle required by FTO's 151-01, and 151-02; on for 20 sec at 6 min 30 sec after PLB Doors close initiation at deorbit. OPS - On for 20 sec at 30 sec after initiation of PLB Doors opening sequence; on for 20 sec at 6 min 30 sec after initiation of PLB Doors closing sequence.
52370200 PBD CTRLN LCH1-4 MT2	150	7677	001,003,435, 437	Same as 52370100
52370300 PBD CTRLN LCH5-8 MT1	150	7677	001,003,005, 435,437	STS-1 - On for 20 sec during each cycle required by FTO's 151-01, and 151-02; on for 20 sec at 7 min after PLB Doors close initiation prior to deorbit rehearsal; on for 20 sec at PLB Doors open initiation after deorbit rehearsal; on for 20 sec at 7 min after PLB Doors close initiation at deorbit. STS-2 - On for 20 sec during each cycle required by FTO's 151-01, and 151-02; on for 20 sec at 7 min after PLB Doors close initiation at deorbit. OPS - On for 20 sec at initiation of PLB Doors opening sequence; on for 20 sec at 7 min after initiation of PLB Doors closing sequence.
52370400 PBD CTRLN LCH5-8 MT2	150	7677	001,003,435, 437	Same as 52370300
52370500 PBD CTRLN LCH9-12 M1	150	7677	001,003,435, 437	Same as 52370300

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52370600 PBD CTRLN LCH9-12 M2	150	7677	001,003,435, 437	Same as 52370300
52370700 PBD CTRLN LH13-16 M1	150	7677	001,003,435, 437	Same as 52370100
52370800 PBD CTRLN LH13-16 M2	150	7677	001,003,435, 437	Same as 52370100
52380 RAD RT LTCH MTRS				FUNCTION: Operate the latches which maintain the radiators in the proper position for boost and entry loads. The two motors in each set are redundant, but both are used together. USAGE: Nominal - On for 26 sec to unlatch the radiators. Manually initiated by the crew after PLB Doors opening to deploy and prior to PLB Doors closing to stow. The two radiators are deployed and stowed simultaneously. The latches can be operated by a single motor in 52 sec. STS-1 - The PLB Doors are operated in accordance with FTO 151-03 after OMS-2. In addition, they are operated during the deorbit rehearsal and again at deorbit per the nominal usage. STS-2 - Some minor variations from the PLB door checkout sequence for STS-1 is expected for STS-2. However,

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				for analysis purposes, the same FTO sequences listed for STS-1 will be used for DTO 251, Payload Bay Door Performance, on STS-2.
				ANALYSIS USAGE:
52380100 RAD LH RT LCH1-6 MT1	62	7677	005,435,437	STS-1 - On for 26 sec as required by FTO 151-03; on for 26 sec at 1 min 18 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 26 sec at 5 min 36 sec after PLB Doors open initiation after deorbit rehearsal; on for 26 sec at 1 min 18 sec after PLB Doors close initiation at deorbit. STS-2 - On for 26 sec as required by FTO 151-03; on for 26 sec at 1 min 18 sec after PLB Doors close initiation at deorbit. OPS - On for 26 sec at 5 min 36 sec after initiation of PLB Doors opening sequence; on for 26 sec at 1 min 18 sec after initiation of PLB Doors closing sequence.
52380200 RAD LH RT LCH1-6 MT2	62	7677	005,435,437	Same as 52380100
52380300 RAD LH RT LCH7-12 M1	62	7677	005,435,437	Same as 52380100
52380400 RAD LH RT LCH7-12 M2	62	7677	005,435,437	Same as 52380100
52380500 RAD RH RT LCH1-6 MT1	62	7677	005,435,437	Same as 52380100
52380600 RAD RH RT LCH1-6 MT2	62	7677	005,435,437	Same as 52380100

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52380700 RAD RH RT LCH7-12 M1	62	7677	005,435,437	Same as 52380100
52380800 RAD RH RT LCH7-12 M2	62	7677	005,435,437	Same as 52380100
52390 RAD DEPLOY DRV MTRS				FUNCTION: Deploy the radiators to the proper position to allow double side exposure and re-stow them to the proper position for entry. The two motors in each set are redundant, but both are used together. USAGE: Nominal - On for 43 sec to deploy or stow the radiators. Manually deployed by the crew after PLB Doors opening, and stowed prior to PLB Doors closing. The two radiators are deployed and stowed simultaneously. Deployment can be accomplished by a single motor in 86 sec. STS-1 - The PLB Doors are operated in accordance with FTO's 151-01, 151-02, and 151-03 after OMS-2. In addition, they are closed and re-opened during the deorbit rehearsal and closed at deorbit per the nominal usage. STS-2 - Some minor variations from the PLB door checkout sequence for STS-1 is expected for STS-2. However, for analysis purposes, the same FTO sequences listed for STS-1 will be used for DTO 251, Payload Bay Door Performance, on STS-2. Note: See 52160 for additional sequencing information.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
52390100 RAD LH DPLY DRV MTR1	62	7677	005,435,437	ANALYSIS USAGE: STS-1 - On for 43 sec as required by FTO 151-03; on for 43 sec at 30 sec after PLB Doors close initiation prior to deorbit rehearsal; on for 43 sec at 6 min 7 sec after PLB Doors open initiation after deorbit rehearsal; on for 43 sec at 30 sec after PLB Doors initiation at deorbit. STS-2 - On for 43 sec as required by FTO 151-03; on for 43 sec at 30 sec after PLB Doors initiation at deorbit. OPS - On for 43 sec at 6 min 7 sec after initiation of PLB Doors opening sequence; on for 43 sec at 30 sec after initiation of PLB Doors closing sequence.
52390200 RAD LH DPLY DRV MTR2	62	7677	005,435,437	Same as 52390100
52390300 RAD RH DPLY DRV MTR1	62	7677	005,435,437	Same as 52390100
52390400 RAD RH DPLY DRV MTR2	62	7677	005,435,437	Same as 52390100
52510 AIRDATA PRB HTRS				FUNCTION: Provide three heater elements in each probe to prevent ice formation. USAGE: All on automatically from probe deployment at 100 Kft during descent until deactivated by the crew after stoproll.

TABLE A-XIX.- MECHANICAL AND LANDING SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
52510100 LEFT ADP HT-MAST	240	7677	503,505	On from 27 min 51 sec after EI until stoproll plus 6 min 30 sec.
52510200 LEFT ADP HT-TTEMP	355	7677	503,505	Same as 52510100
52510300 LEFT ADP HT-PROBE	266	7677	503,505	Same as 52510100
52510400 RIGHT ADP HT-MAST	240	7677	503,505	Same as 52510100
52510500 RIGHT ADP HT-TTEMP	355	7677	503,505	Same as 52510100
52510600 RIGHT ADP HT-PROBE	266	7677	503,505	Same as 52510100

A-XX 6000
CREW

TABLE A-XX.- CREW SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
60010 CREW OPTICAL ALIGN-MENT SIGHT				FUNCTION: Provides a manual, optical backup to the Startrackers for performing IMU alignments. The COAS can align an IMU within approximately 0.25 degrees. The COAS also provides target sighting capability during rendezvous. This item represents the power required by the light which projects the COAS reticle onto the combiner lens. USAGE: On during 2nd phase rendezvous operations (i.e., post NCC). In addition, the COAS will be used during some IMU alignments on STS flights 1 and 2. ANALYSIS USAGE:
60010000 CREW OPTC ALIGN SGHT	12	7677	407,409	STS-1 - On for 45 min, starting 15 min prior to all scheduled IMU alignments STS-2 - On for 45 min, starting 15 min prior to all scheduled IMU alignments OPS - On for 2nd phase rendezvous operations from NCC to the initiation of stationkeeping
60020 SEAT ADJUST ACTUATOR MOTORS				FUNCTION: Adjust seats up and down. USAGE:

TABLE A-XX.- CREW SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				This activity requires less than 1 min and is performed twice, once immediately after insertion and again immediately preceding deorbit. ANALYSIS USAGE:
60020100 SEAT ADJ ACT MTR-LFT	127	0074	211,433	STS-1 - On for 15 sec immediately after insertion, on for 15 sec, beginning 40 min prior to the rehearsal deorbit, and beginning 40 min prior to deorbit STS-2 - On for 15 sec, immediately after insertion and again beginning 40 min prior to deorbit OPS - N/A
60020200 SEAT ADJ ACT MT-RGHT	127	0074	211,433	STS-1 - On for 15 sec immediately after insertion; on for 15 sec beginning 40 min prior to the rehearsal deorbit, and beginning 40 min prior to deorbit STS-2 - On for 15 sec, immediately after insertion and again beginning 40 min prior to deorbit OPS - N/A
60030 ESCAPE SUIT VENT ASSEMBLY UNITS				FUNCTION: Provide comfort cooling for seated crewmen wearing escape suits. An extension hose allows one crewman to move to the aft area. USAGE: On when crewmen are wearing escape suits. Estimates

TABLE A-XX.- CREW SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				are that the units will be on from crew seat-ingress until the payload bay doors are opened and from approximately 2.0 hr prior to deorbit until EOM.
				ANALYSIS USAGE:
60030100 ESCAPE SUIT VT ASY L	96	0074	051,109,123, 433,457	STS-1 - On from pwr xfr int until the initiation of the PLB doors open sequence, from 2 hr prior to until 30 min after the rehearsal deorbit, and from 2 hr prior to deorbit until EOM STS-2 - On from pwr xfr int until the initiation of the PLB door open sequence, and from 2 hr prior to de-orbit until EOM OPS - N/A
60030200 ESCAPE SUIT VT ASY R	96	0074	051,109,123, 433,457	STS-1 - On from pwr xfr int until the initiation of the PLB doors open sequence, from 2 hr prior to until 30 min after the rehearsal deorbit, and from 2 hr prior to deorbit until EOM STS-2 - On from pwr xfr int until the initiation of the PLB door open sequence, and from 2 hr prior to de-orbit until EOM OPS - N/A
60040 EVLSS POWER SUPPLY & BATTERY CHARGER				FUNCTION: Each supply provides regulated power to the EMU prior to switching to the EMU internal battery, and a current limited, modified constant potential used to charge the EMU battery. Estimated power supply efficiency is 80%.

TABLE A-XX.- CREW SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				USAGE:
				Prebreathe Mode - Both on for approximately 3.0 hr prior to, and for approximately 1.0 hr after, each EVA. This interval includes crew prebreathe, EMU donning, and EMU doffing activities.
				Bat Charge Mode - Both on following each EVA for EMU battery recharge. Estimated maximum recharge requirement is 460 w-hr/battery over a 20 hr period.
				ANALYSIS USAGE:
60040100 EVLSS PS/AB1-PR-BRTH	106	7637	417,419	STS-1 - Not used
				STS-2 - Not used
				OPS - On for 3.0 hr prior to each scheduled EVA and for 1.0 hr after each scheduled EVA
60040110 EVLSS PS/AB1-BAT-CHG	39	7637	419	STS-1 - Not used
				STS-2 - Not used
				OPS - On for 20.0 hr, starting 1.0 hr after each scheduled EVA.
60040200 EVLSS PS/BC1-PR-BRTH	106	7637	417,419	Same as 60040100
60040210 EVLSS PS/BC1-BAT-CHG	39	7637	419	Same as 60040110
60050 EMU H_2O SUPPLY				FUNCTION:

TABLE A-XX.- CREW SUBSYSTEM

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				Open valve position allows supply water to enter the EMU, during recharge operations. They are latching valves requiring power only to open or close. USAGE: After initial EVA, valves are cycled to recharge the EMU. Valve actuation time is approximately 2 sec. Recharge time is approximately 20 min. ANALYSIS USAGE:
60050100 EMU 1 H_2O SUPPLY	49	7637	None	Not used (momentary power)
60050200 EMU 2 H_2O SUPPLY	49	7637	None	Not used (momentary power)
60060 EMU WASTE H_2O				FUNCTION: Open valve position allows EMU waste water to be drained to the Waste Collection System holding tank during recharge operations. They are latching valves requiring power only to open or close. USAGE: After initial EVA, values are cycled to recharge the EMU. Valve actuation time is approximately 2 sec. Recharge time is approximately 20 min.

TABLE A-XX.- CREW SUBSYSTEM - Concluded

ID NO/ EQUIPMENT DESCRIPTION	POWER (WATTS)	EFF	ACTIVITY BLOCKS	FUNCTION & USAGE
				ANALYSIS USAGE:
60060100 EMU 1 WASTE H_2O	49	7637	None	Not used (momentary power)
60060200 EMU 2 WASTE H_2O	49	7637	None	Not used (momentary power)

APPENDIX B

ORBITER ELECTRICAL EQUIPMENT

UTILIZATION BASELINE

HEATER USAGE

APPENDIX B

ORBITER ELECTRICAL EQUIPMENT

UTILIZATION BASELINE

HEATER USAGE

The usage of certain components varies, more or less, independently of mission and crew activities, being rather sensitive to flight attitude and beta angle. These components, for the most part, are thermostatically, or similarly, controlled devices designed to operate as a function of temperature. The usage of these components within electrical analyses cannot, in general, be accomplished with a high degree of fidelity. This is due to the vast number of possible attitudes and the limited data available, coupled with the large number of independently varying components which must be considered.

For purposes of JSC analyses, the ANALYSIS USAGE of the affected components has, in most cases, been extrapolated from data contained in available thermal analyses (refs. 5 through 14). Those components for which no thermal analyses data were available, however, have been treated in a much more general manner, as follows:

a. In the absence of any information to the contrary, TCS heaters were considered to cycle continuously when on-orbit, with a 50% duty cycle.

b. When on-orbit, TCS heaters located within the payload bay were considered to cycle continuously with a 50% duty cycle, except when in those attitudes in which the payload bay is in direct sunlight.

c. TCS heaters, for which no thermal analyses data were available were not considered in determining energy-weighted first on-times for use in JSC analyses.

Table B-I is a general table that lists all Orbiter heaters and their corresponding 28 VDC power levels. The remaining tables in this appendix address only those heaters which operate as a function of attitude and beta angle, or in a reasonably consistant manner for certain time periods, regardless of mission, such as ascent or descent. Each table includes only those heaters applicable to the analysis described therein. The items which follow describe the content and use of these tables:

a. Table B-II lists the ANALYSIS USAGE of specifically affected components for the period from power transfer internal until L/O + 90 min. No thermal analysis data were available for this time interval. The usage estimates, contained herein, were primarily derived from reference 14.

b. Table B-III lists the ANALYSIS USAGE of specifically affected components for the period from entry interface until end of mission. No thermal analysis

data were available for this time interval. The usage estimates, contained herein, were primarily derived from reference 14.

c. Table B-IV presents the on-orbit Analysis Usage of Orbiter TCS heaters for STS-1. These data were obtained primarily from reference 6.

d. Table B-V presents the on-orbit Analysis Usage of Orbiter TCS heaters for STS-2. These data were obtained primarily from reference 5.

e. Table B-VI presents the on-orbit Analysis Usage of Orbiter TCS heaters for STS-3. These data were obtained primarily from reference 5.

f. Tables B-VII through B-IX are reserved for presenting on-orbit Orbiter TCS heater data for the remaining OFT flights. These data will be supplied when Orbiter attitudes for these flights are better defined.

g. Table B-X lists the first on-times and estimated maximum energy duty cycles for TCS heaters which are active when on-orbit. The on-times fall into two general categories: those representing components included in the available thermal analysis data, and those for which no thermal analysis data are available. The on-times of components included in the analyses of references 5, 6 and 14 are the averages of the on-times contained therein. On-times greater than 20 hours, however, were standardized at 20 hours. The on-times of components which were not included in the analyses of references 6 and 7 were standardized at the energy weighted average of all components contained therein (i.e. 10.5 hours).

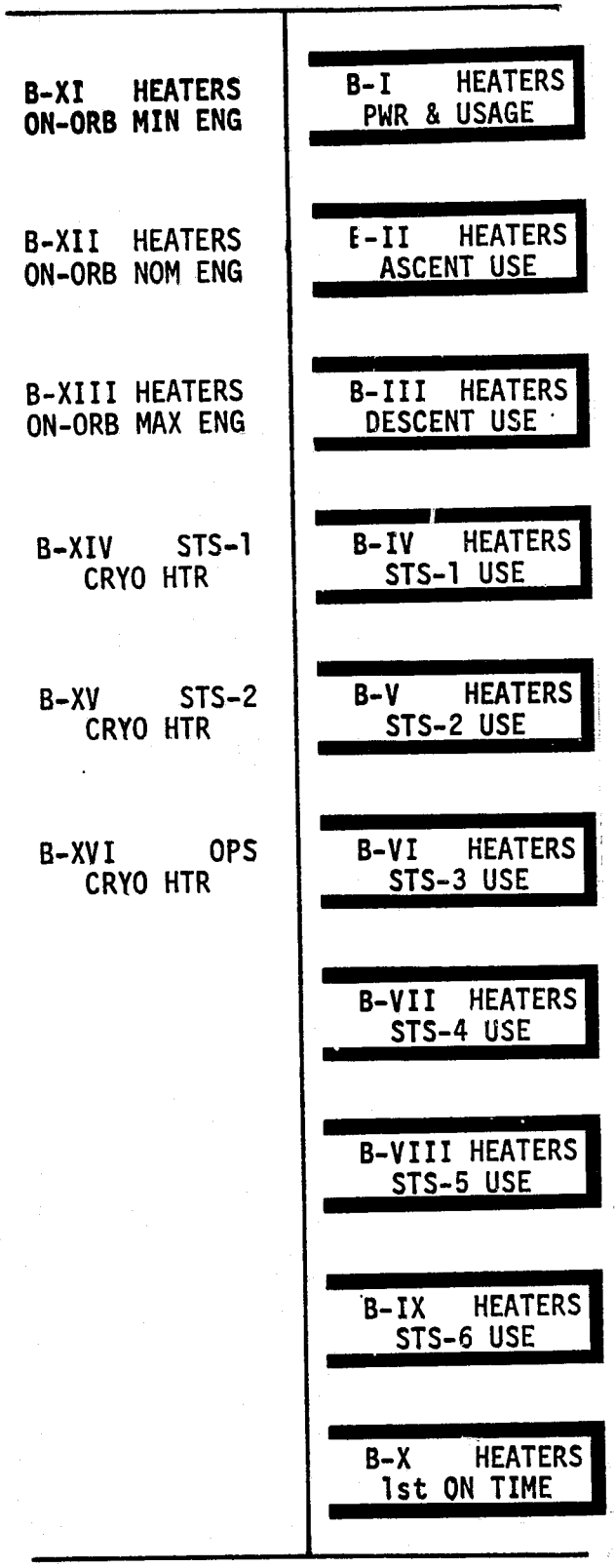
h. The duty cycles presented in table B-X represent the operation of TCS heaters from the stipulated first on-times until 20 hours GET, for the minimum, nominal, and maximum energy cases defined in tables B-XI through B-XIII.

i. Tables B-XI through B-XIII present on-orbit duty cycles (usage factors) for the minimum, nominal, and maximum energy attitudes as determined from the thermal analyses data of references 7 through 13.

j. Table B-XIV presents STS-1 Cryo Heater duty cycles. These data were obtained primarily from the output of the Cryogenic Analysis Program (CAP).

k. Table B-XV presents estimated STS-2 Cryo Heater duty cycles. These data were obtained from cryo tank performance studies from reference 15.

l. Table B-XVI presents estimated Cryo Heater duty cycles for all other flights. These data were obtained from cryo tank performance studies from reference 15.


B-XI HEATERS ON-ORB MIN ENG
B-XII HEATERS ON-ORB NOM ENG
B-XIII HEATERS ON-ORB MAX ENG
B-XIV STS-1 CRYO HTR
B-XV STS-2 CRYO HTR
B-XVI OPS CRYO HTR
B-I HEATERS PWR & USAGE
B-II HEATERS ASCENT USE
B-III HEATERS DESCENT USE
B-IV HEATERS STS-1 USE
B-V HEATERS STS-2 USE
B-VI HEATERS STS-3 USE
B-VII HEATERS STS-4 USE
B-VIII HEATERS STS-5 USE
B-IX HEATERS STS-6 USE
B-X HEATERS 1st ON TIME

B-I HEATERS
PWR & USAGE

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
02810100	19.9	TV CAM HTR - FWD PLB	O
02810200	19.9	TV CAM HTR - AFT PLB	O
02810300	19.9	TV CAM HT - LRMS WRS	O
02810400	19.9	TV CAM HT - LRMS ELB	O
02810500	19.9	TV CAM HTR - KEEL BAY	O
02820100	8.2	PAN TLT HTR - FWD BAY	O
02820200	8.2	PAN TLT HTR - AFT BAY	O
02820300	8.2	PAN TLT HTR - KEEL BAY	O
02820400	8.2	PAN TLT HT - LRMS ELB	O
02850000**	25.0	KUBD DP ASY A CBL HT	A,O,D
02860100	176.0	KUBD DPLY A DEA HTR 1	O
02860200	176.0	KUBD DPLY A DEA HTR 2	R
02860300	231.0	KUBD DPLY A DMA HTR	O
02870100	10.0	GPS PREAMP HTR - UL	Not used
02870200	10.0	GPS PREAMP HTR - LR	Not used
02870300	10.0	GPS PREAMP HTR - UC	Not used
02870400	10.0	GPS PREAMP HTR - LC	Not used
02870500	10.0	GPS PREAMP HTR - UR	Not used
02870600	10.0	GPS PREAMP HTR - LL	Not used
04020000**	100.0	UP LNK TXT/GRAPH HTR	O
04500000	85.0	SILTS POD THRML HTR	O
04510000	50.0	ACIP ELECT HEATER	O

Use Codes: A = Ascent
O = On-Orbit
D = Descent
R = Redundant

A = Enabled after 1 hr 5 min
* = Not heater, however, duty cycles are function of thermal requirements
** = Specific usage, see Appendix A

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
05410100	126.0	DATA CAMERA 1 HEATER	A
05410200	126.0	DATA CAMERA 2 HEATER	A
05410300	126.0	SURVEILLANCE CAM HTR	A
05420100	22.4	PAO CAM HTR - LH WIND	O
05420200	22.4	PAO CAM HTR - CREW	O
05470100	115.2	IECM HEATER ZONE A	O
05470200	69.2	IECM HEATER ZONE B	O
05480000	90.0	REM HEATER	O
05490100	22.4	PLB CAM HT-FD HI CTR	O
05490200	22.4	PLB CAM HT-FD MD PRT	O
05490300	22.4	PLB CAM HT-FD LO PRT	O
05490400	22.4	PLB CAM HT-AF HI CTR	O
05490500	22.4	PLB CAM HT-AF MD PRT	O
05490600	22.4	PLB CAM HT-AF LO PRT	O
08250100*	216.4	OMS PBK CNT A INCR 3	O
08250510*	170.0	OMS PBK CNT A INCR 2	O
08250910	131.4	OMS PBK CNT A INCR 1	O
08510100	1700.0	OMS PBK HTR A - INCR 1	O
08510110	2200.0	OMS PBK HTR A - INCR 2	O
08510120	2600.0	OMS PBK HTR A - INCR 3	O
08510200	1700.0	OMS PBK HTR B - INCR 1	R
08510210	2200.0	OMS PBK HTR B - INCR 2	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
08510220	2600.0	OMS PBK HTR B - INCR 3	R
08520100	25.3	PBK XFER FU LN HTR A	A
08520200	25.3	PBK XFER FU LN HTR B	R
08520300	25.3	PBK XFER OX LN HTR A	A
08520400	25.3	PBK XFER OX LN HTR B	R
08530100	25.3	PBK XFER FUBKD HTR A	A
08530200	25.3	PBK XFER FUBKD HTR B	R
08530300	25.3	PBK XFER OXBKD HTR A	A
08530400	25.3	PBK XFER OXBKD HTR B	R
08540100	14.0	TV CAM HTR - RRMS WRS	O
08540200	14.0	TV CAM HTR - RRMS ELB	O
08550000	5.6	PAN TLT HT - RRMS ELB	O
08650100	214.2	O_2 TANK 4 HEATER A1	O
08650200	218.0	O_2 TANK 4 HEATER A2	O
08650300	212.9	O_2 TANK 4 HEATER B1	O
08650400	218.8	O_2 TANK 4 HEATER B2	O
08660100	95.8	H_2 TANK 4 HEATER A	O
08660200	99.4	H_2 TANK 4 HEATER B	O
08700100	36.0	RRMS SHDR PED HTR-1	O
08700200	27.3	RRMS SHDR YW LD HT-1	O
08700300	18.6	RRMS SHDR PH TO HT-1	O
08700400	56.4	RRMS SHDR EL TR HT-1	O

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
08700500	30.9	RRMS ELB PH TOR HT-1	0
08700600	56.4	RRMS ELB EL TR HTR-1	0
08700700	85.5	RRMS WR FWD TR HTR-1	0
08700800	23.5	RRMS WR PH TOR HTR-1	0
08700900	14.5	RRMS WR YW TOR HTR-1	0
08701100	38.5	RRMS WR ROLL EX HT-1	0
08701200	19.5	RRMS WR ROLL EL HT-1	0
08701300	48.4	RRMS END EFF #1 HT-1	0
08701400	27.5	RRMS END EFF #2 HT-1	0
08710100	36.0	RRMS SHDR PED HTR-2	0
08710200	27.3	RRMS SHDR YW LD HT-2	0
08710300	18.6	RRMS SHDR PH TO HT-2	0
08710400	56.4	RRMS SHDR EL TR HT-2	0
08710500	30.9	RRMS ELB PH TOR HT-2	0
08710600	56.4	RRMS ELB EL TR HTR-2	0
08710700	85.5	RRMS WR FWD TR HTR-2	0
08710800	23.5	RRMS WR PH TOR HTR-2	0
08710900	14.5	RRMS WR YW TOR HTR-2	0
08711100	38.5	RRMS WR ROLL EX HT-2	0
08711200	19.5	RRMS WR ROLL EL HT-2	0
08711300	48.4	RRMS END EFF #1 HT-2	0
08711400	27.5	RRMS END EFF #2 HT-2	0

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
16241100*	2.0	HPU GG HTR A IN LSRB	A
16241200*	2.0	HPU GG HTR B IN LSRB	A
16241300*	2.0	HPU GG HTR A IN RSRB	A
16241400*	2.0	HPU GG HTR B IN RSRB	A
16250100	60.0	HPU A GG HTR 1 - LHSRB	A
16250210	60.0	HPU A GG HTR 2 - LHSRB	R
16250300	60.0	HPU B GG HTR 1 - LHSRB	A
16250410	60.0	HPU B GG HTR 2 - LHSRB	R
16250500	60.0	HPU A GG HTR 1 - RHSRB	A
16250610	60.0	HPU A GG HTR 2 - RHSRB	R
16250700	60.0	HPU B GG HTR 1 - RHSRB	A
16250810	60.0	HPU B GG HTR 2 - RHSRB	R
20510100	283.3	MAIN ENG HTR #1	O
20510200	283.3	MAIN ENG HTR #2	O
20510300	283.3	MAIN ENG HTR #3	O
20520100	340.3	SSME MFV HTR 1	Not used
20520200	340.3	SSME MFV HTR 2	Not used
20520300	340.3	SSME MFV HTR 3	Not used
21510100	43.0	GSE SR PN HT A-43-LP	A,O
21510200	64.5	ENG SR PN HT A-37-LP	A,O
21510300	107.6	OME COVER HT A-53-LP	A,O
21510400	107.6	Y-WB OTBD HT A-27-LP	A,O

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
21510500	107.6	Y-WB INBD HT A-33-LP	A,O
21510600	107.6	Y-WB UPR HT A-31-LP	A,O
21510700	202.2	CT LN WB HT A1-21-LP	A,O
21510800	212.9	CT LN WB HT A2-21-LP	A,O
21510900	106.4	CT LN WB HT A3-21-LP	A,O
21511100	218.2	CT LN WB HT A4-21-LP	A,O
21511200	118.3	RCS HSNG HT A1-41-LP	A,O
21511300	102.1	RCS HSNG HT A2-41-LP	A,O
21520100	43.0	GSE SR PN HT B-51-LP	R
21520200	64.5	ENG SR PN HT B-39-LP	R
21520300	107.6	OME COVER HT B-55-LP	R
21520400	107.6	Y-WB OTBD HT B-25-LP	R
21520500	107.6	Y-WB INBD HT B-35-LP	R
21520600	107.6	Y-WB UPR HT B-29-LP	R
21520700	202.2	CT LN WB HT B1-23-LP	R
21520800	212.9	CT LN WB HT B2-23-LP	R
21520900	106.4	CT LN WB HT B3-23-LP	R
21521100	218.2	CT LN WB HT B4-23-LP	R
21521200	118.3	RCS HSNG HT B1-45-LP	R
21521300	102.1	RCS HSNG HT B2-45-LP	R
21530100	43.0	GSE SR PN HT A-44-RP	A,O
21530200	64.5	ENG SR PN HT A-38-RP	A,O

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
21530300	107.6	OME COVER HT A-54-RP	A,O
21530400	107.6	Y-WB OTBD HT A-28-RP	A,O
21530500	107.6	Y-WB INBD HT A-34-RP	A,O
21530600	107.6	Y-WB UPR HT A-32-RP	A,O
21530700	202.2	CT LN WB HT A1-22-RP	A,O
21530800	212.9	CT LN WB HT A2-22-RP	A,O
21530900	106.4	CT LN WB HT A3-22-RP	A,O
21531100	218.2	CT LN WB HT A4-22-RP	A,O
21531200	118.3	RCS HSNG HT A1-42-RP	A,O
21531300	102.1	RCS HSNG HT A2-42-RP	A,O
21540100	43.0	GSE SR PN HT B-52-RP	R
21540200	64.5	ENG SR PN HT B-40-RP	R
21540300	107.6	OME COVER HT B-56-RP	R
21540400	107.6	Y-WB OTBD HT B-26-RP	R
21540500	107.6	Y-WB INBD HT B-36-RP	R
21540600	107.6	Y-WB UPR HT B-30-RP	R
21540700	202.2	CT LN WB HT B1-24-RP	R
21540800	212.9	CT LN WB HT B2-24-RP	R
21540900	106.4	CT LN WB HT B3-24-RP	R
21541100	218.2	CT LN WB HT B4-24-RP	R
21541200	118.3	RCS HSNG HT B1-46-RP	R
21541300	102.1	RCS HSNG HT B2-46-RP	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
21700100	35.5	XFD OX/FU FLXL HTA-L	A,O,D
21700200	35.5	XFD OX/FU FLXL HTB-L	R
21700300	35.5	XFD OX/FU FLXL HTA-R	A,O,D
21700400	35.5	XFD OX/FU FLXL HTB-R	R
21710100	61.9	XFD OX/FU LNE HT-A-L	A,O,D
21710200	61.9	XFD OX/FU LNE HT-B-L	R
21710300	61.9	XFD OX/FU LNE HT-A-R	A,O,D
21710400	61.9	XFD OX/FU LNE HT-B-R	R
21710500	90.3	XFD OX/FU LNE HT-A-C	A,O,D
21710600	90.3	XFD OX/FU LNE HT-B-C	R
21720100	15.1	FU HIPT BLDLN HT-A-A	A,O,D
21720200	15.1	FU HIPT BLDLN HT-B-A	R
21720300	24.3	FU HIPT BLDLN HT-A-M	A,O,D
21720400	24.3	FU HIPT BLDLN HT-B-M	R
21730100	15.1	OX HIPT BLDLN HT-A-A	A,O,D
21730200	15.1	OX HIPT BLDLN HT-B-A	R
21730300	24.3	OX HIPT BLDLN HT-A-M	A,O,D
21730400	24.3	OX HIPT BLDLN HT-B-M	R
21740100	7.9	LOPT OXFU DRLN HTA-L	A,O,D
21740200	7.9	LOPT OXFU DRLN HTB-L	R
21740300	7.9	LOPT OXFU DRLN HTA-R	A,O,D
21740400	7.9	LOPT OXFU DRLN HTB-R	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
22510100	21.5	FWD RCS HT-ENG F1F-X	A,O,D
22510200	21.5	FWD RCS HT-ENG F1L+Y	A,O,D
22510300	21.5	FWD RCS HT-ENG F1U+Z	A,O,D
22510400	21.5	FWD RCS HT-ENG F1D-Z	A,O,D
22510500	21.5	FWD RCS HT-ENG F2F-X	A,O,D
22510600	21.5	FWD RCS HT-ENG F2R-Y	A,O,D
22510700	21.5	FWD RCS HT-ENG F2U+Z	A,O,D
22510800	21.5	FWD RCS HT-ENG F2D-Z	A,O,D
22510900	21.5	FWD RCS HT-ENG F3F-X	A,O,D
22511100	21.5	FWD RCS HT-ENG F3L+Y	A,O,D
22511200	21.5	FWD RCS HT-ENG F3U+Z	A,O,D
22511300	21.5	FWD RCS HT-ENG F3D-Z	A,O,D
22511400	21.5	FWD RCS HT-ENG F4R-Y	A,O,D
22511500	21.5	FWD RCS HT-ENG F4D-Z	A,O,D
22520100	21.5	AFT RCS HT-ENG R1R-Y	A,O,D
22520200	21.5	AFT RCS HT-ENG R2R-Y	A,O,D
22520300	21.5	AFT RCS HT-ENG R3R-Y	A,O,D
22520400	21.5	AFT RCS HT-ENG R4R-Y	A,O,D
22520500	21.5	AFT RCS HT-ENG R2D-Z	A,O,D
22520600	21.5	AFT RCS HT-ENG R3D-Z	A,O,D
22520700	21.5	AFT RCS HT-ENG R4D-Z	A,O,D
22520800	21.5	AFT RCS HT-ENG R1U+Z	A,O,D

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
22520900	21.5	AFT RCS HT-ENG R2U+Z	A,O,D
22521100	21.5	AFT RCS HT-ENG R4U+Z	A,O,D
22521200	32.3	AFT RCS HT-ENG R1A+X	A,O,D
22521300	32.3	AFT RCS HT-ENG R3A+X	A,O,D
22530100	21.5	AFT RCS HT-ENG L1L+Y	A,O,D
22530200	21.5	AFT RCS HT-ENG L2L+Y	A,O,D
22530300	21.5	AFT RCS HT-ENG L3L+Y	A,O,D
22530400	21.5	AFT RCS HT-ENG L4L+Y	A,O,D
22530500	21.5	AFT RCS HT-ENG L2D-Z	A,O,D
22530600	21.5	AFT RCS HT-ENG L3D-Z	A,O,D
22530700	21.5	AFT RCS HT-ENG L4D-Z	A,O,D
22530800	21.5	AFT RCS HT-ENG L1U+Z	A,O,D
22530900	21.5	AFT RCS HT-ENG L2U+Z	A,O,D
22531100	21.5	AFT RCS HT-ENG L4U+Z	A,O,D
22531200	32.3	AFT RCS HT-ENG L1A+X	A,O,D
22531300	32.3	AFT RCS HT-ENG L3A+X	A,O,D
22540100	10.8	FWD VRN HT-ENG F5R	A,O,D
22540200	10.8	FWD VRN HT-ENG F5L	A,O,D
22550100	10.8	AFT VRN HT-ENG R5D-Z	A,O,D
22550200	10.8	AFT VRN HT-ENG R5R-Y	A,O,D
22550300	10.8	AFT VRN HT-ENG L5D-Z	A,O,D
22550400	10.8	AFT VRN HT-ENG L5L+Y	A,O,D

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
22560100	96.8	FUEL UP PAN 1 HTR A	A,O
22560210	96.8	FUEL UP PAN 1 HTR B	R
22560300	107.5	FUEL FWD PAN 3 HTR A	A,O
22560410	107.5	FUEL FWD PAN 3 HTR B	R
22560500	96.8	FUEL LOW PAN 5 HTR A	A,O
22560610	96.8	FUEL LOW PAN 5 HTR B	R
22570100	96.8	OXID UP PAN 2 HTR A	A,O
22570210	96.8	OXID UP PAN 2 HTR B	R
22570300	107.5	OXID FWD PAN 4 HTR A	A,O
22570410	107.5	OXID FWD PAN 4 HTR B	R
22570500	96.8	OXID LOW PAN 6 HTR A	A,O
22570610	96.8	OXID LOW PAN 6 HTR B	R
30510100**	40.7	GO2 PRG LNE HTR AUT	O
30510210**	40.8	GO2 PRG LNE HTR MAN	O
30520100**	51.6	GH2 PRG LNE HTR AUT	O
30520210**	51.5	GH2 PRG LNE HTR MAN	O
30530100	8.7	H2O VENT LN HTR A	A,O,D
30530210	8.7	H2O VENT LN HTR B	R
30540100	3.4	FCP1 H2O RLF VL HT A	A,O,D
30540210	3.5	FCP1 H2O RLF VL HT B	R
30540300	3.4	FCP2 H2O RLF VL HT A	A,O,D
30540410	3.5	FCP2 H2O RLF VL HT B	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
30540500	3.4	FCP3 H2O RLF VL HT A	A,O,D
30540610	3.5	FCP3 H2O RLF VL HT B	R
30560100	5.7	H2O NOZ BARREL HTR A	A,O,D
30560210	5.7	H2O NOZ BARREL HTR B	R
30570000	48.0	H2O NOZ ORIFICE HT A/B	A,O,D
30590100	32.9	FCP1 H2O LINE HTR A	Not used
30590210	32.9	FCP1 H2O LINE HTR B	R
30590300	21.9	FCP2 H2O LINE HTR A	Not used
30590410	21.9	FCP2 H2O LINE HTR B	R
30590500	21.8	FCP3 H2O LINE HTR A	Not used
30590610	21.8	FCP3 H2O LINE HTR B	R
30600100**	3288.3	FCP1 START HTR	Not used
30600200**	3287.6	FCP2 START HTR	Not used
30600300**	3286.6	FCP3 START HTR	Not used
30601100**	1132.6	FCP1 SUSTAING HTR	Not used
30601200**	1132.2	FCP2 SUSTAING HRT	Not used
30601300**	1132.5	FCP3 SUSTAING HRT	Not used
30610100**	161.0	FCP1 ACC ENDCELL HTR	Not used
30610200**	161.0	FCP2 ACC ENDCELL HTR	Not used
30610300**	161.1	FCP3 ACC ENDCELL HTR	Not used
30610400**	161.0	FCP1 PRB ENDCELL HTR	Not used
30610500**	160.8	FCP2 PRB ENDCELL HTR	Not used

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
30610600**	160.2	FCP3 PRB ENDCELL HTR	Not used
31170100**	210.8	O2 TANK 1 HEATER A1	A,O
31170200**	210.5	O2 TANK 1 HEATER A2	A,O
31170300**	222.5	O2 TANK 2 HEATER A1	A,O
31170400**	220.7	O2 TANK 2 HEATER A2	A,O
31170500**	222.6	O2 TANK 3 HEATER A1	O
31170600**	222.6	O2 TANK 3 HEATER A2	O
31180100	211.7	O2 TANK 1 HEATER B1	O
31180200	215.4	O2 TANK 1 HEATER B2	O
31180300	219.5	O2 TANK 2 HEATER B1	O
31180400	222.7	O2 TANK 2 HEATER B2	O
31180500	222.7	O2 TANK 3 HEATER B1	O
31180600	222.7	O2 TANK 3 HEATER B2	O
31190100**	96.5	H2 TANK 1 HEATER A	A,O
31190200**	97.2	H2 TANK 1 HEATER B	O
31190300**	98.8	H2 TANK 2 HEATER A	A,O
31190400	99.3	H2 TANK 2 HEATER B	O
31190500**	99.3	H2 TANK 3 HEATER A	O
31190600	99.3	H2 TANK 3 HEATER B	O
32030120**	7.0	APU1 CNTLR-HTR OPRN	A,O,D
32030220**	7.0	APU2 CNTLR-HTR OPRN	A,O,D
32030320**	7.0	APU3 CNTLR-HTR OPRN	A,O,D

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
32510100	62.7	TK HTR 1A LH SIDE	O
32510200	62.7	TK HTR 1B LH SIDE	R
32510300	62.7	TK HTR 2A LH SIDE	O
32510400	62.7	TK HTR 2B LH SIDE	R
32510500	62.7	TK HTR 3A RH SIDE	O
32510600	62.7	TK HTR 3B RH SIDE	R
32520100	67.7	FUEL FEEDLINE HTR 1A	A,O,D
32520200	67.7	FUEL FEEDLINE HTR 1B	R
32520300	81.0	FUEL FEEDLINE HTR 2A	A,O,D
32520400	81.0	FUEL FEEDLINE HTR 2B	R
32520500	47.7	FUEL FEEDLINE HTR 3A	A,O,D
32520600	47.7	FUEL FEEDLINE HTR 3B	R
32530100	64.5	FUEL SERVLINE HTR 1A	A,O,D
32530200	64.5	FUEL SERVLINE HTR 1B	R
32530300	47.7	FUEL SERVLINE HTR 2A	A,O,D
32530400	47.7	FUEL SERVLINE HTR 2B	R
32530500	64.5	FUEL SERVLINE HTR 3A	A,O,D
32530600	64.5	FUEL SERVLINE HTR 3B	R
32540100	41.1	FUEL DRN LINE HTR 1A	A,O,D
32540200	41.1	FUEL DRN LINE HTR 1B	R
32540300	53.3	FUEL DRN LINE HTR 2A	A,O,D
32540400	53.3	FUEL DRN LINE HTR 2B	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
32540500	32.7	FUEL DRN LINE HTR 3A	A,O,D
32540600	32.7	FUEL DRN LINE HTR 3B	R
32550100	56.8	FUEL PMP/LINE HTR 1A	A,O
32550210	56.8	FUEL PMP/LINE HTR 1B	R
32550300	56.8	FUEL PMP/LINE HTR 2A	A,O
32550410	56.8	FUEL PMP/LINE HTR 2B	R
32550500	56.8	FUEL PMP/LINE HTR 3A	A,O
32550610	56.8	FUEL PMP/LINE HTR 3B	R
32560100	56.8	TURB GAS GEN HTR 1A	A,O
32560210	56.8	TURB GAS GEN HTR 1B	R
32560300	56.8	TURB GAS GEN HTR 2A	A,O
32560410	56.8	TURB GAS GEN HTR 2B	R
32560500	56.8	TURB GAS GEN HTR 3A	A,O
32560610	56.8	TURB GAS GEN HTR 3B	R
32570100	68.7	OIL LINE HTR 1A	A,O
32570210	68.7	OIL LINE HTR 1B	R
32570300	71.0	OIL LINE HTR 2A	A,O
32570410	71.0	OIL LINE HTR 2B	R
32570500	71.0	OIL LINE HTR 3A	A,O
32570610	71.0	OIL LINE HTR 3B	R
32580100	28.3	APU 1 PRI H2O HTR 1A	A,O,D
32580200	28.3	APU 1 PRI H2O HTR 1B	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
32580300	8.2	APU 2 PRI H20 HTR 1A	A,O,D
32580400	8.2	APU 2 PRI H20 HTR 1B	R
32580500	26.8	APU 3 PRI H20 HTR 1A	A,O,D
32580600	26.8	APU 3 PRI H20 HTR 1B	R
32590100	30.1	APU 1 SEC H20 HTR 2A	A,O,D
32590200	30.1	APU 1 SEC H20 HTR 2B	R
32590300	13.7	APU 2 SEC H20 HTR 2A	A,O,D
32590400	13.7	APU 2 SEC H20 HTR 2B	R
32590500	13.7	APU 3 SEC H20 HTR 2A	A,O,D
32590600	13.7	APU 3 SEC H20 HTR 2B	R
32600100	15.1	PRI H20 TNK PRI HTR	A,O,D
32600200	15.1	PRI H20 TNK SEC HTR	R
32610100	15.1	SEC H20 TNK PRI HTR	A,O,D
32610200	15.1	SEC H20 TNK SEC HTR	R
32620100	12.5	GG H20 TNK PRI HTR	A,O,D
32620200	12.5	GG H20 TNK SEC HTR	R
32630100	12.5	GG H20 TK LN HT SO4A	A,O,D
32630200	12.5	GG H20 TK LN HT SO4B	R
32630300	22.7	GG H20 TK LN HT SO3A	A,O,D
32630400	22.7	GG H20 TK LN HT SO3B	R
40210000**	500.0	WATER HTR-FOOD/HYG	O
40220000**	405.0	OVEN HTR	O

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
40231100**	203.0	FOOD WARMER-OFT PH A	O
40231200**	203.0	FOOD WARMER-OFT PH C	O
40600000	11.4	VACUUM VNT NOZ HTR	O,D
40601100	28.5	VACUUM VNT LNE HTR A	O,D
40601210	28.5	VACUUM VNT LNE HTR B	R
40610000	21.2	POT H2O NOZ HTR	Not used
40611100	13.1	POT H2O DUMP LN HTRA	O
40611210	13.1	POT H2O DUMP LN HTRB	R
40620000	22.0	WASTE NOZZLE HTR	O
40621100	15.2	WASTE DUMP LINE HTRA	O
40621210	15.2	WASTE DUMP LINE HTRB	R
40810100	21.2	PRI FWTR LN HTA-TS5	O
40810210	21.2	PRI FWTR LN HTB-TS8	R
40810300	21.2	PRI FWTR LN HTA-TS6	O
40810410	21.2	PRI FWTR LN HTB-TS9	R
40810500	51.1	PRI FWTR LN HTA-TS7	O
40810610	51.1	PRI FWTR LN HTB-TS10	R
40810700	42.8	PRI FWTR LN HTA-TS5	O
40810810	42.8	PRI FWTR LN HTB-TS2	R
40820100	21.2	SEC FWTR LN HTA-TS11	A,O,D
40820210	21.2	SEC FWTR LN HTB-TS14	R
40820300	21.2	SEC FWTR LN HTA-TS12	A,O,D

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
40820410	21.2	SEC FWTR LN HTB-TS15	R
40820500	51.1	SEC FWTR LN HTA-TS13	A,O,D
40820610	51.1	SEC FWTR LN HTB-TS16	R
40820700	48.4	SEC FWTR LN HTA-TS3	A,O,D
40820810	48.4	SEC FWTR LN HTB-TS4	R
40850100	553.6	HI LD DUCT HTR1 SEC1	A,D
40850210	535.9	HI LD DUCT HTR2 SEC1	R
40850310	565.7	HI LD DUCT HTR3 SEC1	R
40860100	254.6	HI LD DUCT HTR1 SEC2	A,D
40860210	256.5	HI LD DUCT HTR2 SEC2	R
40860310	261.0	HI LD DUCT HTR3 SEC2	R
40870100	130.7	HI LD DCT NOZ HT GP1	A,D
40870210	129.6	HI LD DCT NOZ HT GP2	R
40870310	130.7	HI LD DCT NOZ HT GP3	R
40900100	378.9	TOP'G DUCT HTR1 SEC1	A,O,D
40900210	382.9	TOP'G DUCT HTR2 SEC1	R
40900310	367.7	TOP'G DUCT HTR3 SEC1	R
40910100	468.6	TOP'G DUCT HTR1 SEC2	A,O,D
40910210	479.8	TOP'G DUCT HTR2 SEC2	R
40910310	478.2	TOP'G DUCT HTR3 SEC2	R
40920100	62.8	TOP'G DUCT HTR1 SEC3	A,O,D
40920210	65.3	TOP'G DUCT HTR2 SEC3	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
40930100	64.8	TOP'G DUCT HTR1 SEC4	A,O,D
40930210	64.6	TOP'G DUCT HTR2 SEC4	R
40940100	25.0	SONIC LFT NOZ HTR 1A	A,O,D
40940210	25.0	SONIC LFT NOZ HTR 1B	R
40950100	24.7	SONIC RHT NOZ HTR 2A	A,O,D
40950210	25.0	SONIC RHT NOZ HTR 2B	R
50040000*	18.0	LG RETRACT CIRC VLV	A,O,D
50510100*	1944.0	CIRC MOTOR PUMP #1	A,O,D
50510200*	1944.0	CIRC MOTOR PUMP #2	A,O,D
50510300*	1944.0	CIRC MOTOR PUMP #3	A,O,D
50520100	88.4	LI ELVON ACTR HTR A	O
50520200	88.3	LI ELVON ACTR HTR B	R
50520300	88.9	LO ELVON ACTR HTR A	O
50520400	89.1	LO ELVON ACTR HTR B	R
50520500	88.1	RI ELVON ACTR HTR A	O
50520600	87.8	RI ELVON ACTR HTR B	R
50520700	88.5	RO ELVON ACTR HTR A	O
50520800	88.2	RO ELVON ACTR HTR B	R
50530100	158.9	WSB TK/BOILER HTR 1A	A,O
50530210	161.9	WSB TK/BOILER HTR 1B	R
50530300	154.6	WSB TK/BOILER HTR 2A	A,O
50530410	161.9	WSB TK/BOILER HTR 2B	R

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION

Heater ID no.	Power (watts)	Heater name	Use
50530500	158.9	WSB TK/BOILER HTR 3A	A,O
50530610	162.0	WSB TK/BOILER HTR 3B	R
50540100	73.6	WSB VENT NOZZ HTR 1A	A
50540210	75.2	WSB VENT NOZZ HTR 1B	R
50540300	61.5	WSB VENT NOZZ HTR 2A	A
50540410	74.9	WSB VENT NOZZ HTR 2B	R
50540500	59.1	WSB VENT NOZZ HRT 3A	A
50540610	74.6	WSB VENT NOZZ HTR 3B	R
50550100	43.9	BODYFLAP PDU HTR A	O
50550200	43.9	BODYFLAP PDU HTR B	R
50560100	110.0	RUD SPBK HTR A	O
50560200	110.0	RUD SPBK HTR B	R
50700100	6.5	BDYFLAP A SCD LN HT 1	O
50700200	6.5	BDYFLAP A SCD LN HT 2	R
50700300	1.5	BDYFLAP B SCD LN HT 1	O
50700400	1.5	BDYFLAP B SCD LN HT 2	R
50710100	8.4	RD SPDBK SCD LN HT 1	O
50710200	8.4	RD SPDBK SCD LN HT 2	R
51510100	36.0	LRMS SHDR PED HTR-1	O
51510200	27.3	LRMS SHDR YW LD HT-1	O
51510300	18.6	LRMS SHDR PH TO HT-1	O
51510400	56.4	LRMS SHDR EL TR HT-1	O

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION - Concluded

Heater ID no.	Power (watts)	Heater name	Use
51510500	30.9	LRMS ELB PH TOR HT-1	0
51510600	56.4	LRMS ELB EL TR HTR-1	0
51510700	85.5	LRMS WR FWD TR HTR-1	0
51510800	23.5	LRMS WR PH TOR HTR-1	0
51510900	14.5	LRMS WR YW TOR HTR-1	0
51511100	38.5	LRMS WR ROLL EX HT-1	0
51511200	19.5	LRMS WR ROLL EL HT-1	0
51511300	48.4	LRMS END EFF #1 HT-1	0
51511400	27.5	LRMS END EFF #2 HT-1	0
51610100	36.0	LRMS SHDR FWD HTR-2	0
51610200	27.3	LRMS SHDR YW LD HT-2	0
51610300	18.6	LRMS SHDR PH TO HT-2	0
51610400	56.4	LRMS SHDR EL TR HT-2	0
51610500	30.9	LRMS ELB PH TOR HTR-2	0
51610600	56.4	LRMS ELB EL TR HTR-2	0
51610700	85.5	LRMS WR FWD TR HTR-2	0
51610800	23.5	LRMS WR PH TOR HTR-2	0
51610900	14.5	LRMS WR YW TOR HTR-2	0
51611100	38.5	LRMS WR ROLL EX HT-2	0
51611200	19.5	LRMS ROLL EL HT-2	0
51611300	48.4	LRMS END EFF #1 HT-2	0
51611400	27.5	LRMS END EFF #2 HT-2	0

TABLE B-I.- HEATER POWER AND USAGE DESCRIPTION - Concluded

Heater ID no.	Power (watts)	Heater name	Use
52510100**	240.0	LEFT ADP HT-MAST	D
52510200**	355.0	LEFT ADP HT-TTEMP	D
52510300**	266.0	LEFT ADP HT-PROBE	D
52510400**	240.0	RIGHT ADP HT-MAST	D
52510500**	355.0	RIGHT ADP HT-TTEMP	D
52510600**	266.0	RIGHT ADP HT-PROBE	D

B-II HEATERS
ASCENT USE

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
08520100	100	100	100	On from pwr xfr int to orbital conditions at T + 90 min
08520300	100	100	100	On from pwr xfr int to orbital conditions at T + 90 min
08530100	100	100	100	On from pwr xfr int to orbital conditions at T + 90 min
08530300	100	100	100	On from pwr xfr int to orbital conditions at T + 90 min
16241100	90.0	0	0	From pwr xfr int to L/O - 22 sec
16241200	90.0	0	0	From pwr xfr int to L/O - 22 sec
16241300	90.0	0	0	From pwr xfr int to L/O - 22 sec
16241400	90.0	0	0	From pwr xfr int to L/O - 22 sec
16250100	90.0	0	0	From pwr xfr int to L/O - 22 sec
16250300	90.0	0	0	From pwr xfr int to L/O - 22 sec
16250500	90.0	0	0	From pwr xfr int to L/O - 22 sec
16250700	90.0	0	0	From pwr xfr int to L/O - 22 sec
21510100	0	0	4.5	Off until enabled at 1 hr 5 min
21510200	0	0	0	Off until enabled at 1 hr 5 min
21510300	0	0	8.0	Off until enabled at 1 hr 5 min
21510400	0	0	17.5	Off until enabled at 1 hr 5 min
21510500	0	0	10.0	Off until enabled at 1 hr 5 min
21510600	0	0	0	Off until enabled at 1 hr 5 min
21510700	0	0	17.0	Off until enabled at 1 hr 5 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
21510800	0	0	17.0	Off until enabled at 1 hr 5 min
21510900	0	0	17.0	Off until enabled at 1 hr 5 min
21511100	0	0	17.0	Off until enabled at 1 hr 5 min
21511200	0	0	8.0	Off until enabled at 1 hr 5 min
21511300	0	0	8.0	Off until enabled at 1 hr 5 min
21530100	0	0	4.5	Off until enabled at 1 hr 5 min
21530200	0	0	0	Off until enabled at 1 hr 5 min
21530300	0	0	8.0	Off until enabled at 1 hr 5 min
21530400	0	0	17.5	Off until enabled at 1 hr 5 min
21530500	0	0	10.0	Off until enabled at 1 hr 5 min
21530600	0	0	0	Off until enabled at 1 hr 5 min
21530700	0	0	17.0	Off until enabled at 1 hr 5 min
21530800	0	0	17.0	Off until enabled at 1 hr 5 min
21530900	0	0	17.0	Off until enabled at 1 hr 5 min
21531100	0	0	17.0	Off until enabled at 1 hr 5 min
21531200	0	0	8.0	Off until enabled at 1 hr 5 min
21531300	0	0	8.0	Off until enabled at 1 hr 5 min
21700100	80.0	57.4	25.9	On from pwr xfr int to orbital conditions at T + 90 min
21700300	80.0	57.4	25.9	On from pwr xfr int to orbital conditions at T + 90 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
21710100	60.0	43.5	20.5	On from pwr xfr int to orbital conditions at T + 90 min
21710300	60.0	43.5	20.5	On from pwr xfr int to orbital conditions at T + 90 min
21710500	80.0	55.3	20.8	On from pwr xfr int to orbital conditions at T + 90 min
21720100	80.0	58.2	27.7	On from pwr xfr int to orbital conditions at T + 90 min
21720300	0	8.2	19.7	On from pwr xfr int to orbital conditions at T + 90 min
21730100	80.0	58.2	27.7	On from pwr xfr int to orbital conditions at T + 90 min
21730300	0	8.2	19.7	On from pwr xfr int to orbital conditions at T + 90 min
21740100	100	69.2	26.2	On from pwr xfr int to orbital conditons at T + 90 min
21740300	100	69.2	26.2	On from pwr xfr int to orbital conditions at T + 90 min
22510100	0	0	11.4	Off until enabled at 1 hr 5 min
22510200	0	0	12.1	Off until enabled at 1 hr 5 min
22510300	0	0	10.0	Off until enabled at 1 hr 5 min
22510400	0	0	17.5	Off until enabled at 1 hr 5 min
22510500	0	0	11.4	Off until enabled at 1 hr 5 min
22510600	0	0	13.8	Off until enabled at 1 hr 5 min
22510700	0	0	10.0	Off until enabled at 1 hr 5 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
22510800	0	0	17.3	Off until enabled at 1 hr 5 min
22510900	0	0	12.9	Off until enabled at 1 hr 5 min
22511100	0	0	13.5	Off until enabled at 1 hr 5 min
22511200	0	0	9.5	Off until enabled at 1 hr 5 min
22511300	0	0	19.5	Off until enabled at 1 hr 5 min
22511400	0	0	12.1	Off until enabled at 1 hr 5 min
22511500	0	0	17.7	Off until enabled at 1 hr 5 min
22520100	0	0	11.0	Off until enabled at 1 hr 5 min
22520200	0	0	11.5	Off until enabled at 1 hr 5 min
22520300	0	0	11.0	Off until enabled at 1 hr 5 min
22520400	0	0	11.0	Off until enabled at 1 hr 5 min
22520500	0	0	7.0	Off until enabled at 1 hr 5 min
22520600	0	0	7.0	Off until enabled at 1 hr 5 min
22520700	0	0	7.0	Off until enabled at 1 hr 5 min
22520800	0	0	10.5	Off until enabled at 1 hr 5 min
22520900	0	0	10.5	Off until enabled at 1 hr 5 min
22521100	0	0	10.5	Off until enabled at 1 hr 5 min
22521200	0	0	8.0	Off until enabled at 1 hr 5 min
22521300	0	0	8.5	Off until enabled at 1 hr 5 min
22530100	0	0	11.0	Off until enabled at 1 hr 5 min
22530200	0	0	11.5	Off until enabled at 1 hr 5 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
22530300	0	0	11.0	Off until enabled at 1 hr 5 min
22530400	0	0	11.0	Off until enabled at 1 hr 5 min
22530500	0	0	7.0	Off until enabled at 1 hr 5 min
22530600	0	0	7.0	Off until enabled at 1 hr 5 min
22530700	0	0	7.0	Off until enabled at 1 hr 5 min
22530800	0	0	10.5	Off until enabled at 1 hr 5 min
22530900	0	0	10.5	Off until enabled at 1 hr 5 min
22531100	0	0	10.5	Off until enabled at 1 hr 5 min
22531200	0	0	1.5	Off until enabled at 1 hr 5 min
22531300	0	0	8.5	Off until enabled at 1 hr 5 min
22540100	0	0	13.5	Off until enabled at 1 hr 5 min
22540200	0	0	11.6	Off until enabled at 1 hr 5 min
22550100	0	0	0	Off until enabled at 1 hr 5 min
22550200	0	0	8.5	Off until enabled at 1 hr 5 min
22550300	0	0	0	Off until enabled at 1 hr 5 min
22550400	0	0	8.5	Off until enabled at 1 hr 5 min
22560100	0	0	3.9	Off until enabled at 1 hr 5 min
22560300	0	0	3.9	Off until enabled at 1 hr 5 min
22560500	0	0	3.9	Off until enabled at 1 hr 5 min
22570100	0	0	6.2	Off until enabled at 1 hr 5 min
22570300	0	0	6.2	Off until enabled at 1 hr 5 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
22570500	0	0	6.2	Off until enabled at 1 hr 5 min
30560100	0	0	100	Off until enabled at 1 hr 5 min
30570000	0	0	25.0	Off until enabled at 1 hr 5 min
32030120	100	100	100	On from pwr xfr int to L/O - 5 min, then from 3 min after insertion (SRB Sep + 13 min 29 sec) until 5 min prior to deorbit. (APU start)
32030220	100	100	100	On from pwr xfr int to L/O - 5 min, then from 3 min after insertion (SRB Sep + 13 min 29 sec) until 5 min prior to deorbit. (APU start)
32030320	100	100	100	On from pwr xfr int to L/O - 5 min, then from 3 min after insertion (SRB Sep + 13 min 29 sec) until 5 min prior to deorbit. (APU start)
32510100	0	0	0	Reflects duty cycles if propellant temperature is 70°F or greater
32510300	0	0	0	Reflects duty cycles if propellant temperature is 70°F or greater
32510500	0	0	0	Reflects duty cycles if propellant temperature is 70°F or greater
32520100	45.0	4.7	11.2	On from pwr xfr int to orbital conditions at T + 90 min
32520300	45.0	4.7	11.2	On from pwr xfr int to orbital conditions at T + 90 min
32520500	45.0	4.7	11.2	On from pwr xfr int to orbital conditions at T + 90 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
32530100	50.0	37.5	20.0	On from pwr xfr int to orbital conditions at T + 90 min
32530300	50.0	37.5	20.0	On from pwr xfr int to orbital conditions at T + 90 min
32530500	50.0	37.5	20.0	On from pwr xfr int to orbital conditions at T + 90 min
32540100	0	5.4	12.9	Enabled, but off until SRB Sep, then on thru orbital conditions at 90 min
32540300	0	5.4	12.9	Enabled, but off until SRB Sep, then on thru orbital conditions at 90 min
32540500	0	5.4	12.9	Enabled, but off until SRB Sep, then on thru orbital conditions at 90 min
32550100	32.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32550300	32.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32550500	32.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32560100	62.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32560300	61.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min

B-II (A).- ASCENT COMMON HEATER USAGE

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
32560500	60.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32570100	15.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32570300	15.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min
32570500	15.0	0	0	On from pwr xfr int to L/OFF, then off, although enabled, thru orbital conditions at 90 min

B-II (B).- ASCENT WARM DAY LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
05410100	50.0	50.0	0	On until MECO + 4 min 55 sec (11 min 34 sec after SRB Sep)
05410200	50.0	50.0	0	On until MECO + 4 min 55 sec (11 min 34 sec after SRB Sep)
05410300	50.0	50.0	0	On until MECO + 4 min 55 sec (11 min 34 sec after SRB Sep)
32580100	60.0	51.1	38.6	Enabled during ascent
32580300	60.0	51.1	38.6	Enabled during ascent
32580500	60.0	51.1	38.6	Enabled during ascent
32590100	60.0	51.1	38.6	Enabled during ascent
32590300	60.0	51.1	38.6	Enabled during ascent
32590500	60.0	51.1	38.6	Enabled during ascent
32600100	0	0	0	Enabled during ascent
32610100	0	0	0	Enabled during ascent
32620100	0	0	0	Enabled during ascent
32630100	60.0	51.1	38.6	Enabled during ascent
32630300	60.0	51.1	38.6	Enabled during ascent
40820100	0	2.3	5.6	Off until T + 14 min (SRB Sep + 11 min 56 sec)
40820300	0	5.6	14.0	Off until T + 14 min (SRB Sep + 11 min 56 sec)
40820500	0	7.0	17.5	Off until T + 14 min (SRB Sep + 11 min 56 sec)

B-II (B).- ASCENT WARM DAY LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
40820700	0	3.7	9.2	Off until T + 14 min (SRB Sep + 11 min 56 sec)
40850100	42.0	72.1	33.1	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40860100	33.0	66.4	19.4	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40870100	96.0	66.7	20.2	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40900100	91.0	69.2	26.2	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40910100	100	69.9	27.9	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40920100	100	74.9	39.9	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40930100	100	75.7	41.7	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min

B-II (B).- ASCENT WARM DAY LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
40940100	0	74.9	39.9	Enabled but off until SRB Sep, then on with specified usage to orbital conditions at T + 90 min
40950100	0	75.7	41.7	Enabled but off until SRB Sep, then on with specified usage to orbital conditions at T + 90 min
50530100	5.0	4.6	4.1	On from pwr xfr int until orbital conditions at T + 90 min
50530300	5.0	5.4	5.9	On from pwr xfr int until orbital conditions at T + 90 min
50530500	5.0	5.4	5.9	On from pwr xfr int until orbital conditions at T + 90 min
50540100	41.3	100	0	On from pwr xfr int until L/O + 30 sec, then on at 100% usage until SRB Sep + 20 min, then turned off by crew
50540300	41.3	100	0	On from pwr xfr int until L/O + 30 sec, then on at 100% usage until SRB Sep + 20 min, then turned off by crew
50540500	41.3	100	0	On from pwr xfr int until L/O + 30 sec, then on at 100% usage until SRB Sep + 20 min, then turned off by crew

B-II (C).- ASCENT COLD DAY LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
05410100	76.0	76.0	0	On until MECO + 4 min 55 sec (SRB Sep + 11 min 34 sec)
05410200	76.0	76.0	0	On until MECO + 4 min 55 sec (SRB Sep + 11 min 34 sec)
05410300	76.0	76.0	0	On until MECO + 4 min 55 sec (SRB Sep + 11 min 34 sec)
32580100	90.0	70.3	42.8	Enabled during ascent
32580300	90.0	70.3	42.8	Enabled during ascent
32580500	90.0	70.3	42.8	Enabled during ascent
32590100	90.0	70.3	42.8	Enabled during ascent
32590300	90.0	70.3	42.8	Enabled during ascent
32590500	90.0	70.3	42.8	Enabled during ascent
32600100	100	64.2	14.2	Enabled durin ascent
32610100	100	64.2	14.2	Enabled during ascent
32620100	100	64.2	14.2	Enabled during ascent
32630100	90.0	70.3	42.8	Enabled during ascent
32630300	90.0	70.3	42.8	Enabled during ascent
40820100	0	68.7	22.1	OFF until T + ' (SRB Sep + 11 min 56 sec
40820300	0	72.1	30.4	OFF until T + 1[illegible] 'SRB Sep + 11 min 56 sec)
40820500	0	73.5	33.9	OFF until T + 14 min, (SRB Sep + 11 min 56 sec)

B-II (C).- ASCENT COLD DAY LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
40820700	0	70.1	25.6	OFF until T + 14 min, (SRB Sep + 11 min 56 sec)
40850100	45.0	72.1	33.1	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40850100	36.0	66.4	19.4	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40870100	100	66.7	20.2	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40900100	100	69.2	26.2	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40910100	100	69.9	27.9	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40920100	100	74.9	39.9	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40930100	100	75.7	41.7	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min

B-II (C).- ASCENT COLD DAY LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to SRB sep	SRB sep to Crew conf	Crew conf to 90 min	Remarks
40940100	100	74.9	39.9	On until T - 5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
40950100	100	75.7	41.7	On until T -5 min, then off until SRB Sep, then on with specified usage until orbital conditions at T + 90 min
50530100	17.0	12.3	5.8	On from pwr xfr int until orbital conditions at T + 90 min
50530300	18.0	13.7	7.7	On from pwr xfr int until orbital conditions at T + 90 min
50530500	17.0	13.1	7.6	On from pwr xfr int until orbital conditions at T + 90 min
50540100	52.2	100	0	On from pwr xfr int until L/off + 30 sec, then on at 100% usage until turned off by crew at SRB Sep + 20 min
50540300	52.2	100	0	On from pwr xfr int until L/off + 30 sec, then on at 100% usage until turned off by crew at SRB Sep + 20 min
50540500	52.2	100	0	On from pwr xfr int until L/off + 30 sec, then on at 100% usage until turned off by crew at SRB Sep + 20 min

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
05410100	100	0	On until MECO + 4 min 55 sec (13 min 38 sec after L/off)
05410200	100	0	On until MECO + 4 min 55 sec (13 min 38 sec after L/off)
05410300	100	0	On until MECO + 4 min 55 sec (13 min 38 sec after L/off)
08520100	100	100	On from pwr xfr int to orbital conditions at T + 90 min
08520300	100	100	On from pwr xfr int to orbital conditions at T + 90 min
08530100	100	100	On from pwr xfr int to orbital conditions at T + 90 min
08530300	100	100	On from pwr xfr int to orbital conditions at T + 90 min
16241100	100	0	From pwr xfr int to L/O - 22 sec
16241200	100	0	From pwr xfr int to L/O - 22 sec
16241300	100	0	From pwr xfr int to L/O - 22 sec
16241400	100	0	From pwr xfr int to L/O - 22 sec
16250100	100	0	From pwr xfr int to L/O - 22 sec
16250300	100	0	From pwr xfr int to L/O - 22 sec
16250500	100	0	From pwr xfr int to L/O - 22 sec
16250700	100	0	From pwr xfr int to L/O - 22 sec
21510100	0	100	Off until enabled at 1 hr 5 min
21510200	0	0	Off until enabled at 1 hr 5 min

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
21410300	0	100	Off until enabled at 1 hr 5 min
21510400	0	100	Off until enabled at 1 hr 5 min
21510500	0	100	Off until enabled at 1 hr 5 min
21510600	0	0	Off until enabled at 1 hr 5 min
21510700	0	100	Off until enabled at 1 hr 5 min
21510800	0	100	Off until enabled at 1 hr 5 min
21510900	0	100	Off until enabled at 1 hr 5 min
21511100	0	100	Off until enabled at 1 hr 5 min
21511200	0	100	Off until enabled at 1 hr 5 min
21511300	0	100	Off until enabled at 1 hr 5 min
21530100	0	100	Off until enabled at 1 hr 5 min
21530200	0	0	Off until enabled at 1 hr 5 min
21530300	0	100	Off until enabled at 1 hr 5 min
21530400	0	100	Off until enabled at 1 hr 5 min
21530500	0	100	Off until enabled at 1 hr 5 min
21530600	0	0	Off until enabled at 1 hr 5 min
21530700	0	100	Off until enabled at 1 hr 5 min
21530800	0	100	Off until enabled at 1 hr 5 min
21530900	0	100	Off until enabled at 1 hr 5 min
21531100	0	100	Off until enabled at 1 hr 5 min
21531200	0	100	Off until enabled at 1 hr 5 min

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
21531300	0	100	Off until enabled at 1 hr 5 min
21700100	100	100	On from pwr xfr int to orbital conditions
21700300	100	100	On from pwr xfr int to orbital conditions
21710100	100	100	On from pwr xfr int to orbital conditions
21710300	100	100	On from pwr xfr int to orbital conditions
21710500	100	100	On from pwr xfr int to orbital conditions
21720100	100	100	On from pwr xfr int to orbital conditions
21720300	100	100	On from pwr xfr int to orbital conditions
21730100	100	100	On from pwr xfr int to orbital conditions
21730300	100	100	On from pwr xfr int to orbital conditions
21740100	100	100	On from pwr xfr int to orbital conditions
21740300	100	100	On from pwr xfr int to orbital conditions
22510100	0	100	Off until enabled at 1 hr 5 min
22510200	0	100	Off until enabled at 1 hr 5 min
22510300	0	100	Off until enabled at 1 hr 5 min
22510400	0	100	Off until enabled at 1 hr 5 min
22510500	0	100	Off until enabled at 1 hr 5 min
22510600	0	100	Off until enabled at 1 hr 5 min
22510700	0	100	Off until enabled at 1 hr 5 min
22510800	0	100	Off until enabled at 1 hr 5 min
22510900	0	100	Off until enabled at 1 hr 5 min

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
22511100	0	100	Off until enabled at 1 hr 5 min
22511200	0	100	Off until enabled at 1 hr 5 min
22511300	0	100	Off until enabled at 1 hr 5 min
22511400	0	100	Off until enabled at 1 hr 5 min
22511500	0	100	Off until enabled at 1 hr 5 min
22520100	0	100	Off until enabled at 1 hr 5 min
22520200	0	100	Off until enabled at 1 hr 5 min
22520300	0	100	Off until enabled at 1 hr 5 min
22520400	0	100	Off until enabled at 1 hr 5 min
22520500	0	100	Off until enabled at 1 hr 5 min
22520600	0	100	Off until enabled at 1 hr 5 min
22520700	0	100	Off until enabled at 1 hr 5 min
22520800	0	100	Off until enabled at 1 hr 5 min
22520900	0	100	Off until enabled at 1 hr 5 min
22521100	0	100	Off until enabled at 1 hr 5 min
22521200	0	100	Off until enabled at 1 hr 5 min
22521300	0	100	Off until enabled at 1 hr 5 min
22530100	0	100	Off until enabled at 1 hr 5 min
22530200	0	100	Off until enabled at 1 hr 5 min
22530300	0	100	Off until enabled at 1 hr 5 min
22530400	0	100	Off until enabled at 1 hr 5 min

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
22530500	0	100	Off until enabled at 1 hr 5 min
22530600	0	100	Off until enabled at 1 hr 5 min
22530700	0	100	Off until enabled at 1 hr 5 min
22530800	0	100	Off until enabled at 1 hr 5 min
22530900	0	100	Off until enabled at 1 hr 5 min
22531100	0	100	Off until enabled at 1 hr 5 min
22531200	0	100	Off until enabled at 1 hr 5 min
22531300	0	100	Off until enabled at 1 hr 5 min
22540100	0	100	Off until enabled at 1 hr 5 min
22540200	0	100	Off until enabled at 1 hr 5 min
22550100	0	0	Enabled at 1 hr 5 min, no usage is expected
22550200	0	100	Off until enabled at 1 hr 5 min
22550300	0	0	Enabled at 1 hr 5 min, no usage is expected
22550400	0	100	Off until enabled at 1 hr 5 min
22560100	0	100	Off until enabled at 1 hr 5 min
22560300	0	100	Off until enabled at 1 hr 5 min
22560500	0	100	Off until enabled at 1 hr 5 min
22570100	0	100	Off until enabled at 1 hr 5 min
22570300	0	100	Off until enabled at 1 hr 5 min
22570500	0	100	Off until enabled at 1 hr 5 min

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
30560100	0	100	Off until enabled at 1 hr 5 min
30570000	0	100	Off until enabled at 1 hr 5 min
32030120	100	100	Enabled during ascent
32030220	100	100	Enabled during ascent
32030320	100	100	Enabled during ascent
32510100	0	0	Enabled during ascent, no usage is expected
32510300	0	0	Enabled during ascent, no usage is expected
32510500	0	0	Enabled during ascent, no usage is expected
32520100	100	100	Enabled during ascent
32520300	100	100	Enabled during ascent
32520500	100	100	Enabled during ascent
32530100	100	100	Enabled during ascent
32530300	100	100	Enabled during ascent
32530500	100	100	Enabled during ascent
32540100	100	100	Enabled during ascent
32540300	100	100	Enabled during ascent
32540500	100	100	Enabled during ascent
32550100	100	0	Enabled but predicted to be off after L/off
32550300	100	0	Enabled but predicted to be off after L/off

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
32550500	100	0	Enabled but predicted to be off after L/off
32560100	100	0	Enabled but predicted to be off after L/off
32560300	100	0	Enabled but predicted to be off after L/off
32560500	100	0	Enabled but predicted to be off after L/off
32570100	100	0	Enabled but predicted to be off after L/off
32570300	100	0	Enabled but predicted to be off after L/off
32570500	100	0	Enabled but predicted to be off after L/off
32580100	100	100	Enabled during ascent
32580300	100	100	Enabled during ascent
32580500	100	100	Enabled during ascent
32590100	100	100	Enabled during ascent
32590300	100	100	Enabled during ascent
32590500	100	100	Enabled during ascent
32600100	100	100	Enabled during ascent
32610100	100	100	Enabled during ascent
32620100	100	100	Enabled during ascent
32630100	100	100	Enabled during ascent

B-II (D).- ASCENT WORST CASE LAUNCH

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
32630300	100	100	Enabled during ascent
40820100	100	100	Off until L/off plus 14 min., then on at 100% until orbital conditions at T + 90 min
40820300	100	100	Off until L/off plus 14 min., then on at 100% until orbital conditions at T + 90 min
40820500	100	100	Off until L/off plus 14 min., then on at 100% until orbital conditions at T + 90 min
40820700	100	100	Off until L/off plus 14 min., then on at 100% until orbital conditions at T + 90 min
40850100	100	100	On at 100% until turned off at T - 5 min. Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40860100	100	100	On at 100% until turned off at T - 5 min. Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40870100	100	100	On at 100% until turned off at T - 5 min. Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40900100	100	100	On at 100% until turned off at T - 5 min. Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40910100	100	100	On at 100% until turned off at T - 5 min. Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40920100	100	100	On at 100% until turned off at T - 5 min. Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min

B-II (D).- ASCENT WORST CASE LAUNCH - Concluded

Duty cycle (usage factor) - percent

Heater ID no.	Lift-off to Crew conf	Crew conf to 90 min	Remarks
40930100	100	100	On at 100% until turned off at T - 5 min Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40940100	100	100	On at 100% until turned off at T - 5 min Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
40950100	100	100	On at 100% until turned off at T - 5 min Off until T + 2 min, then on at 100% until orbital conditions at T + 90 min
50530100	100	100	On from pwr xfr int until orbital operations
50530300	100	100	On from pwr xfr int until orbital operations
50530500	100	100	On from pwr xfr int until orbital operations
50540100	100	0	On from pwr xfr int until disabled at T + 22 min
50540300	100	0	On from pwr xfr int until disabled at T + 22 min
50540500	100	0	On from pwr xfr int until disabled at T + 22 min

B-III HEATERS
DESCENT USE

TABLE B-III.- DESCENT HEATER USAGE

Heater ID no.[a]	Duty cycle (usage factor), percent	Remarks
02850000[b]	50.0	From 30 min prior to PLB doors close until close sequence starts
21700100	17.0	From 400 K ft to SR + 6.5 min
21700300	18.0	From 400 K ft to SR + 6.5 min
21710100	10.0	From 400 K ft to SR + 6.5 min
21710300	10.0	From 400 K ft to SR + 6.5 min
21710500	10.0	From 400 K ft to SR + 6.5 min
21720100	19.0	From 400 K ft to SR + 6.5 min
21720300	22.0	From 400 K ft to SR + 6.5 min
21730100	19.0	From 400 K ft to SR + 6.5 min
21730300	23.0	From 400 K ft to SR + 6.5 min
21740100	5.0	From 400 K ft to SR + 6.5 min
21740300	5.0	From 400 K ft to SR + 6.5 min
22510100	11.8	From 400 K ft to SR + 6.5 min
22510200	12.9	From 400 K ft to SR + 6.5 min
22510300	9.8	From 400 K ft to SR + 6.5 min
22510400	17.1	From 400 K ft to SR + 6.5 min
22510500	13.3	From 400 K ft to SR + 6.5 min
22510600	13.4	From 400 K ft to SR + 6.5 min
22510700	10.0	From 400 K ft to SR + 6.5 min
22510800	17.9	From 400 K ft to SR + 6.5 min
22510900	12.2	From 400 K ft to SR + 6.5 min
22511100	13.5	From 400 K ft to SR + 6.5 min

[a]TCS heaters not tabulated herein are not used in analyses of descent.
[b]Post OFT.

TABLE B-III.- DESCENT HEATER USAGE

Heater ID no.[a]	Duty cycle (usage factor), percent	Remarks
22511200	9.5	From 400 K ft to SR + 6.5 min
22511300	19.7	From 400 K ft to SR + 6.5 min
22511400	12.9	From 400 K ft to SR + 6.5 min
22511500	16.8	From 400 K ft to SR + 6.5 min
22520100	10.5	From 400 K ft to SR + 6.5 min
22520200	11.0	From 400 K ft to SR + 6.5 min
22520300	11.0	From 400 K ft to SR + 6.5 min
22520400	11.0	From 400 K ft to SR + 6.5 min
22520500	6.5	From 400 K ft to SR + 6.5 min
22520600	6.5	From 400 K ft to SR + 6.5 min
22520700	6.5	From 400 K ft to SR + 6.5 min
22520800	10.0	From 400 K ft to SR + 6.5 min
22520900	10.0	From 400 K ft to SR + 6.5 min
22521100	10.0	From 400 K ft to SR + 6.5 min
22521200	0.5	From 400 K ft to SR + 6.5 min
22521300	1.0	From 400 K ft to SR + 6.5 min
22530100	10.5	From 400 K ft to SR + 6.5 min
22530200	11.0	From 400 K ft to SR + 6.5 min
22530300	11.0	From 400 K ft to SR + 6.5 min
22530400	11.0	From 400 K ft to SR + 6.5 min
22530500	6.5	From 400 K ft to SR + 6.5 min
22530600	6.5	From 400 K ft to SR + 6.5 min

[a]TCS heaters not tabulated herein are not used in analyses of descent.
[b]Post OFT.

TABLE B-III.- DESCENT HEATER USAGE

Heater ID no.[a]	Duty cycle (usage factor), percent	Remarks
22530700	6.5	From 400 K ft to SR + 6.5 min
22530800	10.0	From 400 K ft to SR + 6.5 min
22530900	10.0	From 400 K ft to SR + 6.5 min
22531100	10.0	From 400 K ft to SR + 6.5 min
22531200	0.5	From 400 K ft to SR + 6.5 min
22531300	1.0	From 400 K ft to SR + 6.5 min
22540100	13.5	From 400 K ft to SR + 6.5 min
22540200	9.6	From 400 K ft to SR + 6.5 min
22550100	0.0	From 400 K ft to SR + 6.5 min
22550200	6.0	From 400 K ft to SR + 6.5 min
22550300	0.0	From 400 K ft to SR + 6.5 min
22550400	6.0	From 400 K ft to SR + 6.5 min
30530100	12.5	From 400 K ft to SR + 6.5 min
30540100	12.5	From 400 K ft to SR + 6.5 min
30540300	12.5	From 400 K ft to SR + 6.5 min
30540500	12.5	From 400 K ft to SR + 6.5 min
30560100	100.0	From 400 K ft to SR + 6.5 min
30570000	0.0	From 400 K ft to SR + 6.5 min
32520100	24.0	From 400 K ft to SR + 6.5 min
32520300	24.0	From 400 K ft to SR + 6.5 min
32520500	22.0	From 400 K ft to SR + 6.5 min
32530100	23.0	From 400 K ft to SR + 6.5 min

[a]TCS heaters not tabulated herein are not used in analyses of descent.
[b]Post OFT.

TABLE B-III.- DESCENT HEATER USAGE

Heater ID no.[a]	Duty cycle (usage factor), percent	Remarks
32530300	23.0	From 400 K ft to SR + 6.5 min
32530500	24.0	From 400 K ft to SR + 6.5 min
32540100	26.0	From 400 K ft to SR + 6.5 min
32540300	26.0	From 400 K ft to SR + 6.5 min
32540500	25.0	From 400 K ft to SR + 6.5 min
32580100	35.0	From 400 K ft to SR + 6.5 min
32580300	35.0	From 400 K ft to SR + 6.5 min
32580500	35.0	From 400 K ft to SR + 6.5 min
32590100	35.0	From 400 K ft to SR + 6.5 min
32590300	35.0	From 400 K ft to SR + 6.5 min
32590500	35.0	From 400 K ft to SR + 6.5 min
32600100	0	N/A
32610100	0	N/A
32620100	0	N/A
32630100	35.0	From 400 K ft to SR + 6.5 min
32630300	35.0	From 400 K ft to SR + 6.5 min
40820100	7.0	From 400 K ft to SR + 6.5 min
40820300	17.1	From 400 K ft to SR + 6.5 min
40820500	22.6	From 400 K ft to SR + 6.5 min
40820700	10.0	From 400 K ft to SR + 6.5 min
40850100	100.0	From EI for 24 min 25 sec (100 K ft)
40860100	100.0	From EI for 24 min 25 sec (100 K ft)

[a]TCS heaters not tabulated herein are not used in analyses of descent.
[b]Post OFT.

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TABLE B-III.- DESCENT HEATER USAGE

Heater ID no.[a]	Duty cycle (usage factor), percent	Remarks
40870100	100.0	From EI for 24 min 25 sec (100 K ft)
40900100	100.0	From EI for 24 min 25 sec (100 K ft)
40900100	43.0	From 24 min 25 sec after EI to SR + 6.5 min
40910100	100.0	From EI for 24 min 25 sec (100 K ft)
40910100	42.5	From 24 min 25 sec after EI to SR + 6.5 min
40920100	100.0	From EI for 24 min 25 sec (100 K ft)
40920100	35.0	From 24 min 25 sec after EI to SR + 6.5 min
40930100	100.0	From EI for 24 min 25 sec (100 K ft)
40930100	35.0	From 24 min 25 sec after EI to SR + 6.5 min
40940100	100.0	From EI for 24 min 25 sec (100 K ft)
40940100	35.0	From 24 min 25 sec after EI to SR + 6.5 min
40950100	100.0	From EI for 24 min 25 sec (100 K ft)
40950100	35.0	From 24 min 25 sec after EI to SR + 6.5 min
50040000	100.0	From SR + 2.5 min to EOM
50510100	100.0	From SR + 2.5 min to EOM
50510200	100.0	From SR + 2.5 min to EOM
50510300	100.0	From SR + 2.5 min to EOM
52510100	100.0	From 27 min 51 sec (40 K ft) after EI until 6 min 30 sec after SR

[a]TCS heaters not tabulated herein are not used in analyses of descent.
[b]Post OFT.

TABLE B-III.- DESCENT HEATER USAGE - **Concluded**

Heater ID no.[a]	Duty cycle (usage factor), percent	Remarks
52510200	100.0	From 27 min 51 sec (40 K ft) after EI until 6 min 30 sec after SR
52510300	100.0	From 27 min 51 sec (40 K ft) after EI until 6 min 30 sec after SR
52510400	100.0	From 27 min 51 sec (40 K ft) after EI until 6 min 30 sec after SR
52510500	100.0	From 27 min 51 sec (40 K ft) after EI until 6 min 30 sec after SR
52510600	100.0	From 27 min 51 sec (40 K ft) after EI until 6 min 30 sec after SR

[a]TCS heaters not tabulated herein are not used in analyses of descent.
[b]Post OFT.

B-IV HEATERS
STS-1 USE

TABLE B-IV.- STS-1 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
02810100	25.00	40.00	On
02810200	25.00	40.00	On
02810500	25.00	40.00	On
02920100	25.00	40.00	On
02820200	25.00	40.00	On
02820300	25.00	40.00	On
04510000	0	0 [b]	N/A
05470100	25.00	25.00	0
05470200	25.00	25.00	On
21510100	13.95	22.71[b]	On
21510200	0	16.61[b]	10.0
21510300	33.19	35.23[b]	1.5
21510400	69.70	24.96[b]	7.5
21510500	13.94	21.40[b]	4.5
21510600	0	5.63[b]	18.5
21510700	38.62	35.53[b]	1.5
21510800	38.62	35.53[b]	1.5
21510900	38.62	35.53[b]	1.5
21511100	38.62	35.53[b]	1.5
21511200	10.89	19.20[b]	On

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

TABLE B-IV.- STS-1 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
21511300	10.89	19.20[b]	On
21530100	13.95	22.71[b]	On
21530200	0	16.61[b]	10.0
21530300	33.19	35.23[b]	1.5
21530400	69.70	24.96[b]	7.5
21530500	13.94	21.40[b]	4.5
21530600	0	5.63[b]	18.5
21530700	38.62	35.53[b]	1.5
21530800	38.62	35.53[b]	1.5
21530900	38.62	35.53[b]	1.5
21531100	38.62	35.53[b]	1.5
21531200	10.89	19.20[b]	On
21531300	10.89	19.20[b]	On
21700100	14.08	30.13	On
21700300	14.08	30.13	On
21710100	25.85	12.02	On
21710300	25.85	12.02	On
21710500	22.15	10.82	On
21720100	79.47	27.72	On
21720300	20.58	27.75	On

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

TABLE B-IV.- STS-1 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
21730100	79.47	30.80	On
21730300	20.58	28.71	On
21740100	37.97	17.66	On
21740300	37.97	17.66	On
22510100	30.23	20.66	6.5
22510200	0	7.04	16.5
22510300	19.77	16.44	4.5
22510400	0	8.91	15.5
22510500	30.23	20.98	6.5
22510600	0	8.01	15.5
22510700	20.93	16.12	4.5
22510800	0	11.21	12.5
22510900	69.77	17.85	7.5
22511100	0	7.19	18.5
22511200	19.77	15.90	4.5
22511300	0	8.91	15.5
22511400	0	7.33	18.5
22511500	0	8.91	15.5
22520100	2.33	3.35	4.5
22520200	2.33	3.35	4.5

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

TABLE B-IV.- STS-1 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
22520300	2.33	3.35	4.5
22520400	3.49	3.35	4.5
22520500	4.65	2.92	2.5
22520600	4.65	2.92	2.5
22520700	4.65	2.92	2.5
22520800	4.65	4.98	On
22520900	4.65	4.98	On
22521100	4.65	4.98	On
22521200	1.86	3.31	On
22521300	6.19	7.34	On
22530100	2.33	3.35	4.5
22530200	2.33	3.35	4.5
22530300	2.33	3.35	4.5
22530400	3.49	3.35	4.5
22530500	4.65	2.92	2.5
22530600	4.65	2.92	2.5
22530700	4.65	2.92	2.5
22530800	4.65	4.98	On
22530900	4.65	4.98	On
22531100	4.65	4.98	On

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

TABLE B-IV.- STS-1 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
22531200	1.86	3.31	On
22531300	6.19	7.34	On
22540100	0	11.16	12.5
22540200	0	9.77	15.5
22550100	7.41	7.75	On
22550200	37.03	36.60	On
22550300	7.41	7.75	On
22550400	37.03	36.60	On
30530100	0	5.00	11.0
30540100	0	5.08	11.0
30540300	0	5.08	11.0
30540500	0	5.08	11.0
30560100	100.00	100.00	On
30570000	50.00	50.00	On
32520100	18.16	19.13	On
32520300	18.16	19.32	On
32520500	16.77	21.94	On
32530100	17.05	19.11	On
32530300	16.93	18.97	On
32530500	15.50	17.31	On

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

TABLE B-IV.- STS-1 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
32540100	15.89	18.96	On
32540300	15.89	18.98	On
32540500	15.29	17.07	On
32560100	0	57.73	10.0
32560300	0	57.73	10.0
32560500	0	57.73	10.0
32570100	14.32	15.94	3.5
32570300	14.32	16.02	3.5
32570500	16.90	16.38	3.5
32580100	35.00	35.00	On
32580300	35.00	35.00	On
32580500	35.00	35.00	On
32590100	35.00	35.00	On
32590300	35.00	35.00	On
32590500	35.00	35.00	On
32600100	0	0	N/A
32610100	0	0	N/A
32620100	0	0	N/A
32630100	35.00	35.00	On
32630300	35.00	35.00	On

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

TABLE B-IV.- STS-1 HEATER USAGE - Concluded

Heater ID no.[a]	Duty cycle (percent) (PTC or ZLV) 1.5 - 10.0 hrs	Duty cycle (percent) (PTC) 10.0 - 53.0 hrs	1st on time After T + 1.5 hrs
40600000	100.00	100.00	2.5
40810100	6.29	7.24	7.0
40810300	13.10	14.26	On
40810500	12.21	15.16	On
40810700	4.67	6.52	On
40820100	0	4.78	11.0
40820300	10.60	13.56	On
40820500	14.19	18.46	On
40820700	8.26	8.17	On
40900100	12.67	12.28	On
40910100	24.75	24.81	On
40920100	42.99	41.88	On
40930100	41.67	40.59	On
40940100	46.40	45.02	On
40950100	46.40	45.02	On
50530100	4.72	3.81	4.5
50530300	6.47	5.42	2.5
50530500	4.20	4.83	4.0

[a]TCS heaters that are not tabulated herein are not used in STS-1 analyses.
[b]Disabled for descent during deorbit prep activities.

B-V HEATERS
STS-2 USE

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
02810100	25.00	25.00	On
02810200	25.00	25.00	On
02810300	25.00	25.00	On
02810400	25.00	25.00	On
02810500	25.00	25.00	On
02820100	25.00	25.00	On
02820200	25.00	25.00	On
02820300	25.00	25.00	On
02820400	25.00	25.00	On
04510000	12.00	12.00*	On
05470100	25.00	25.00	On
05470200	25.00	25.00	On
05480000	25.00	25.00	On
05490100	25.00	15.00	On
05490200	25.00	15.00	On
05490300	25.00	15.00	On
05490400	25.00	15.00	On
05490500	25.00	15.00	On
05490600	25.00	15.00	On
21510100	6.74	20.50*	On
21510200	6.04	0.0*	9.5
21510300	12.89	34.31*	1.5
21510400	31.27	10.29*	7.5

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
21510500	16.64	8.23*	4.5
21510600	0.0	0.0*	N/A
21510700	31.95	39.93*	1.5
21510800	31.95	39.93*	1.5
21510900	31.95	39.93*	1.5
21511100	31.95	39.93*	1.5
21511200	13.49	16.08*	On
21511300	13.49	16.08*	On
21530100	6.74	20.50*	On
21530200	6.04	0.0*	9.5
21530300	12.89	34.31*	1.5
21530400	31.27	10.29*	7.5
21530500	16.64	8.23*	4.5
21530600	0.0	0.0*	N/A
21530700	31.95	39.93*	1.5
21530800	31.95	39.93*	1.5
21530900	31.95	39.93*	1.5
21531100	31.95	39.93*	1.5
21531200	13.49	16.08*	On
21531300	13.49	16.08*	On
21700100	24.50	20.72	On
21700300	21.78	20.72	On
21710100	10.58	45.11	On

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
21710300	10.58	45.11	On
21710500	9.39	32.54	On
21720100	10.58	45.07	On
21720300	28.28	24.19	On
21730100	10.58	45.07	On
21730300	28.73	30.23	On
21740100	24.50	0.0	On
21740300	21.78	0.0	On
22510100	18.20	9.00	6.5
22510200	24.73	0.0	11.5
22510300	15.00	12.00	4.5
22510400	34.98	0.0	10.5
22510500	18.36	9.00	6.5
22510600	23.97	0.0	10.5
22510700	15.16	12.00	4.5
22510800	35.18	0.0	9.5
22510900	15.37	10.00	7.5
22511100	24.73	0.0	11.5
22511200	14.57	12.00	4.5
22511300	34.63	0.0	10.5
22511400	24.38	0.0	11.5
22511500	34.18	0.0	10.5
22520100	14.73	0.0	4.5

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
22520200	14.73	0.0	4.5
22520300	14.73	0.0	4.5
22520400	14.75	0.0	4.5
22520500	6.31	7.00	2.5
22520600	6.31	7.00	2.5
22520700	6.31	7.00	2.5
22520800	5.94	7.00	On
22520900	5.94	7.00	On
22521100	5.94	7.00	On
22521200	1.72	14.00	On
22521300	20.55	14.00	On
22530100	14.73	0.0	4.5
22530200	14.73	0.0	4.5
22530300	14.73	0.0	4.5
22530400	14.73	0.0	4.5
22530500	6.31	4.00	2.5
22530600	6.31	4.00	2.5
22530700	6.31	4.00	2.5
22530800	5.94	8.54	On
22530900	5.94	8.54	On
22531100	5.94	8.54	On
22531200	1.72	3.00	On
22531300	20.55	9.00	On

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
22540100	35.18	0.0	9.5
22540200	34.98	0.0	10.5
22550100	4.87	1.00	On
22550200	51.71	55.00	On
22550300	4.87	1.00	On
22550400	51.71	55.00	On
22560100	6.50	0.0*	42.5
22560300	6.50	0.0*	42.5
22560500	6.50	0.0*	42.5
22570100	13.24	0.0*	22.5
22570300	13.24	0.0*	22.5
22570500	13.24	0.0*	22.5
30530100	5.00	5.00	7.0
30540100	7.61	0.0	7.0
30540300	10.01	1.33	7.0
30540500	7.61	0.0	7.0
30560100	100.00	100.00	On
30570000	50.00	68.60	On
32510100	0.0	0.0	N/A
32510300	0.0	0.0	N/A
32510500	0.0	0.0	N/A
32520100	23.61	26.80	On
32520300	23.61	26.80	On

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
32520500	21.16	24.70	On
32530100	17.89	23.69	On
32530300	17.89	23.69	On
32530500	16.23	22.79	On
32540100	18.54	23.22	On
32540300	18.54	23.22	On
32540500	16.75	22.47	On
32550100	0.0	0.0	N/A
32550300	0.0	0.0	N/A
32550500	0.0	0.0	N/A
32560100	67.58	0.0	On
32560300	67.15	0.0	On
32560500	67.37	0.0	On
32570100	15.02	21.00	3.5
32570300	15.02	21.00	3.5
32570500	30.53	49.68	3.5
32580100	35.00	30.00	On
32580300	35.00	30.00	On
32580500	35.00	30.00	On
32590100	35.00	30.00	On
32590300	35.00	30.00	On
32590500	35.00	30.00	On
32600100	0.0	0.0	N/A

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
32610100	0.0	0.0	N/A
32620100	0.0	0.0	N/A
32630100	35.00	30.00	On
32630300	35.00	30.00	On
40600000	100.00	100.00*	2.5
40601100	10.01	1.32*	7.0
40610000	13.00	0.0*	13.5
40611100	0.0	0.0*	N/A
40620000	4.16	0.0*	13.5
40621100	0.0	0.0*	N/A
40810100	10.01	1.32	7.0
40810300	17.22	13.37	1.5
40810500	17.26	13.52	1.0
40810700	6.14	6.86	On
40820100	7.61	0.0	7.0
40820300	15.86	11.42	1.5
40820500	20.98	17.64	1.0
40820700	8.14	12.14	On
40900100	12.01	18.96	On
40910100	24.09	36.24	On
40920100	40.36	63.19	On
40930100	39.11	61.24	On
40940100	39.11	61.26	On

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
40950100	40.36	63.13	On
50040000	0.0	0.0	N/A
50510100	0.0	0.0	N/A
50510200	0.0	0.0	N/A
50510300	0.0	0.0	N/A
50520100	0.0	0.0*	N/A
50520300	0.0	0.0*	N/A
50520500	0.0	0.0*	N/A
50520700	0.0	0.0*	N/A
50530100	3.25	6.92	4.5
50530300	4.50	12.67	4.0
50530500	4.38	6.91	4.5
50550100	0.0	0.0*	N/A
50560100	0.0	0.0*	N/A
50700100	0.0	0.0*	N/A
50700300	0.0	0.0*	N/A
50710100	0.0	0.0*	N/A
51510100	20.00	20.00*	On
51510200	20.00	20.00*	On
51510300	20.00	20.00*	On
51510400	20.00	20.00*	On
51510500	20.00	20.00*	On
51510600	20.00	20.00*	On

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

TABLE B-V.- STS-2 HEATER USAGE - Concluded

Heater ID no.[a]	Duty cycle (percent) (-ZLV) 1.5 - 93.1 hrs	Duty cycle (percent) (PTC) 93.1 - 100.2 hrs	1st on time After T + 1.5 hrs
51510700	20.00	20.00*	On
51510800	20.00	20.00*	On
51510900	20.00	20.00*	On
51511100	20.00	20.00*	On
51511200	20.00	20.00*	On
51511300	20.00	20.00*	On
51511400	20.00	20.00*	On
51610100	20.00	20.00*	On
51610200	20.00	20.00*	On
51610300	20.00	20.00*	On
51610400	20.00	20.00*	On
51610500	20.00	20.00*	On
51610600	20.00	20.00*	On
51610700	20.00	20.00*	On
51610800	20.00	20.00*	On
51610900	20.00	20.00*	On
51611100	20.00	20.00*	On
51611200	20.00	20.00*	On
51611300	20.00	20.00*	On
51611400	20.00	20.00*	On

[a]TCS heaters not tabulated herein are not used in STS-2 analyses.
*Disabled for descent during deorbit prep activities.

B-VI HEATERS
STS-3 USE

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
02810100	25.00	50.00	75.00	0.0	25.00	On
02810200	25.00	50.00	75.00	0.0	25.00	On
02810300	25.00	50.00	75.00	0.0	25.00	On
02810400	25.00	50.00	75.00	0.0	25.00	On
02810500	25.00	50.00	75.00	0.0	25.00	On
02820100	25.00	50.00	75.00	0.0	25.00	On
02820200	25.00	50.00	75.00	0.0	25.00	On
02820300	25.00	50.00	75.00	0.0	25.00	On
02820400	25.00	50.00	75.00	0.0	25.00	On
04510000	12.00	12.00	36.00	12.00	12.00*	On
05470100	25.00	50.00	75.00	0.0	25.00	On
05470200	25.00	50.00	75.00	0.0	25.00	On
05480000	25.00	50.00	75.00	0.0	25.00	On
05490100	15.00	20.00	30.00	0.0	15.00	On
05490200	15.00	20.00	30.00	0.0	15.00	On
05490300	15.00	20.00	30.00	0.0	15.00	On
05490400	15.00	20.00	30.00	0.0	15.00	On
05490500	15.00	20.00	30.00	0.0	15.00	On
05490600	15.00	20.00	30.00	0.0	15.00	On
08520100	59.20	27.17	3.24	25.00	49.40	On
08520300	61.26	26.30	3.29	25.00	51.00	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
08530100	59.20	27.17	3.24	25.00	49.40	On
08530300	61.26	26.30	3.29	25.00	51.05	On
20510100	0.0	0.0	13.80	0.0	0.0	78.0
20510200	0.0	0.0	16.30	.40	0.0	71.5
20510300	0.0	0.0	13.40	5.83	0.0	71.5
21510100	13.95	5.80	28.42	9.83	11.62*	On
21510200	0.0	0.0	26.49	16.69	2.00*	43.5
21510300	33.19	2.80	49.35	3.21	19.36*	1.5
21510400	69.70	14.30	37.89	16.80	5.00*	7.5
21510500	13.94	2.90	29.20	21.44	6.19*	4.5
21510600	0.0	0.0	15.30	0.0	1.00*	58.5
21510700	38.62	40.20	43.50	35.20	20.90*	1.5
21510800	38.62	40.20	43.50	35.20	20.90*	1.5
21510900	38.62	40.20	43.50	35.20	20.90*	1.5
21511100	38.62	40.20	43.50	35.20	20.90*	1.5
21511200	10.89	6.23	30.33	2.84	6.80*	On
21511300	10.89	6.23	30.34	1.78	6.80*	On
21530100	13.95	5.80	28.42	9.83	11.62*	On
21530200	0.0	0.0	26.49	16.69	1.29*	43.5
21530300	33.19	2.83	49.35	3.21	19.36*	1.5
21530400	69.70	14.30	37.89	16.80	4.64*	7.5

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
21530500	13.94	2.97	29.20	21.44	6.19*	4.5
21530600	0.0	0.0	15.30	0.0	0.77*	58.5
21530700	38.62	40.23	43.50	35.20	20.95*	1.5
21530800	38.62	40.23	43.50	35.20	20.96*	1.5
21530900	38.62	40.23	43.50	35.20	21.14*	1.5
21531100	38.62	40.23	43.50	35.20	20.92*	1.5
21531200	10.89	6.23	30.33	2.84	6.80*	On
21531300	10.89	6.23	30.34	1.78	6.80*	On
21700100	14.08	21.10	35.90	31.41	11.73	On
21700300	14.08	21.50	36.18	31.41	11.73	On
21710100	25.85	8.74	16.15	8.69	25.57	On
21710300	25.85	8.74	16.69	7.45	25.57	On
21710500	22.15	7.80	14.76	9.37	18.45	On
21720100	79.47	8.74	16.15	8.69	25.57	On
21720300	20.58	39.38	48.46	30.07	13.71	On
21730100	79.47	10.05	16.68	7.45	25.57	On
21730300	20.58	37.71	49.83	30.07	17.14	On
21740100	37.97	27.10	35.96	9.07	0.0	On
21740300	37.97	27.50	36.17	9.07	0.0	On
22510100	30.23	59.10	4.70	0.0	5.03	6.5
22510200	0.0	33.15	6.04	18.42	0.0	10.5

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
22510300	19.77	43.59	12.50	0.0	6.58	4.5
22510400	0.0	45.70	7.23	24.68	0.0	10.5
22510500	30.23	59.30	4.75	0.0	5.03	6.5
22510600	0.0	33.30	6.25	17.88	0.0	10.5
22510700	20.93	47.40	12.60	30.00	6.97	4.5
22510800	0.0	47.30	8.87	24.68	0.0	10.0
22510900	69.77	57.70	4.23	0.0	5.81	7.5
22511100	0.0	32.0	5.37	17.53	0.0	10.5
22511200	19.77	43.00	12.40	0.0	6.58	4.5
22511300	0.0	46.30	8.63	77.45	0.0	10.5
22511400	0.0	31.30	5.58	17.35	0.0	10.5
22511500	0.0	45.40	8.42	24.32	0.0	10.5
22520100	2.33	13.50	15.50	14.31	0.0	4.5
22520200	2.33	13.50	15.50	14.31	0.0	4.5
22520300	2.33	13.50	15.50	14.31	0.0	4.5
22520400	3.49	13.50	15.50	14.31	0.0	4.5
22520500	4.65	1.92	10.85	12.52	3.87	2.5
22520600	4.65	1.92	10.85	12.52	3.87	2.5
22520700	4.65	1.92	10.85	12.52	3.87	2.5
22520800	4.65	13.50	14.47	0.0	3.87	On
22520900	4.65	13.50	14.47	0.0	3.87	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
22521100	4.65	13.50	14.47	0.0	3.87	On
22521200	1.86	1.20	10.66	2.38	7.73	On
22521300	6.19	1.20	11.00	4.76	7.73	On
22530100	2.33	13.50	15.50	14.31	0.0	4.5
22530200	2.33	13.50	15.50	14.31	0.0	4.5
22530300	2.33	13.50	15.50	14.31	0.0	4.5
22530400	3.49	13.50	15.50	14.31	0.0	4.5
22530500	4.65	1.92	10.85	12.52	7.72	2.5
22530600	4.65	1.92	10.85	12.52	7.72	2.5
22530700	4.65	1.92	10.85	12.52	3.87	2.5
22530800	4.65	13.50	14.47	0.0	3.87	On
22530900	4.65	13.50	14.47	0.0	3.87	On
22531100	4.65	13.50	14.47	0.0	3.87	On
22531200	1.86	1.20	10.66	2.38	7.73	On
22531300	6.19	1.20	11.00	4.76	7.73	On
22540100	0.0	13.50	8.78	24.68	0.0	10.0
22540200	0.0	13.50	7.23	24.68	0.0	10.5
22550100	7.41	13.50	10.28	14.24	7.71	On
22550200	37.03	13.50	15.43	14.24	7.71	On
22550300	7.41	1.92	10.28	14.24	7.71	On
22550400	37.03	1.92	15.43	14.24	7.71	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
22560100	0.0	14.45	.72	3.29	0.0*	13.5
22560300	0.0	14.45	.72	3.29	0.0*	13.5
22560500	0.0	14.45	.72	3.29	0.0*	13.5
22570100	0.0	19.21	1.31	8.97	0.0*	13.5
22570300	0.0	19.20	1.31	8.97	0.0*	13.5
22570500	0.0	19.20	1.31	8.97	0.0*	13.5
30530100	0.0	5.00	5.00	5.00	0.0	11.0
30540100	0.0	7.84	14.67	10.88	7.84	10.0
30540300	0.0	11.78	17.80	12.69	1.96	10.0
30540500	0.0	7.85	14.66	10.88	0.78	10.0
30560100	100.00	100.00	100.00	100.00	100.00	On
30570000	50.00	50.00	50.00	50.00	50.00	On
32510100	0.0	0.0	4.96	0.0	0.0	93.5
32510300	0.0	0.0	4.96	10.42	0.0	93.5
32510500	0.0	0.0	4.96	3.06	0.0	93.5
32520100	18.16	18.21	22.80	17.84	10.60	On
32520300	18.16	18.21	22.80	17.84	10.60	On
32520500	16.77	17.47	20.03	12.90	10.98	On
32530100	17.05	20.42	27.32	20.90	14.10	On
32530300	16.93	20.42	27.32	20.90	14.11	On
32530500	15.50	18.73	24.97	19.08	12.91	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
32540100	15.89	22.06	27.20	21.17	13.24	On
32540300	15.89	22.06	27.30	21.17	13.24	On
32540500	15.29	20.38	24.80	18.81	12.74	On
32550100	0.0	0.0	0.0	0.0	0.0	N/A
32550300	0.0	0.0	0.0	0.0	0.0	N/A
32550500	0.0	0.0	0.0	0.0	0.0	N/A
32560100	0.0	55.75	64.74	65.60	0.0	10.0
32560300	0.0	55.75	64.74	65.60	0.0	10.0
32560500	0.0	55.75	64.74	65.60	0.0	10.0
32570100	14.32	16.57	11.92	17.30	5.96	3.5
32570300	14.32	16.39	11.92	17.30	5.96	3.5
32570500	16.90	32.86	42.09	36.20	14.08	3.5
32580100	35.00	35.00	35.00	35.00	35.00	On
32580300	35.00	35.00	35.00	35.00	35.00	On
32580500	35.00	35.00	35.00	35.00	35.00	On
32590100	35.00	35.00	35.00	35.00	35.00	On
32590300	35.00	35.00	35.00	35.00	35.00	On
32590500	35.00	35.00	35.00	35.00	35.00	On
32600100	0.0	0.0	0.0	0.0	0.0	N/A
32610100	0.0	0.0	0.0	0.0	0.0	N/A
32620100	0.0	0.0	0.0	0.0	0.0	N/A

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
32630100	35.00	35.00	35.00	35.00	35.00	On
32630300	35.00	35.00	35.00	35.00	35.00	On
40600000	100.00	100.00	100.00	100.00	100.00*	2.5
40601100	0.0	11.79	17.80	12.69	1.96*	10.0
40610000	0.0	13.00	13.00	13.00	0.0*	13.5
40611100	0.0	0.0	6.0	0.0	0.0*	59.0
40620000	0.0	4.16	4.16	4.16	0.0*	13.5
40621100	0.0	0.0	6.0	0.0	0.0*	59.0
40810100	6.29	11.79	17.80	12.69	3.93	7.0
40810300	13.10	27.50	25.15	19.95	7.86	On
40810500	12.21	22.00	28.26	23.33	8.15	On
40810700	4.67	7.78	9.08	8.08	3.89	On
40820100	0.0	7.86	14.67	10.88	3.93	11.0
40820300	10.60	21.61	26.20	18.14	7.86	On
40820500	14.19	27.72	35.00	27.09	8.15	On
40820700	8.26	9.46	12.62	11.12	6.88	On
40900100	12.67	12.42	13.46	12.79	10.77	On
40910100	24.75	14.84	16.50	16.08	12.98	On
40920100	42.99	39.80	49.18	45.93	35.82	On
40930100	41.67	37.90	47.66	43.92	34.72	On
40940100	46.40	37.90	47.66	43.92	34.73	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
40950100	46.40	39.80	49.18	45.93	35.82	On
50040000	0.0	13.42	15.70	3.00	0.0	10.0
50510100	0.0	13.42	15.70	1.27	0.0	10.0
50510200	0.0	13.42	15.70	1.27	0.0	10.0
50510300	0.0	13.42	15.70	1.27	0.0	10.0
50520100	0.0	73.52	30.66	0.0	0.0*	30.5
50520300	0.0	100.00	30.99	6.92	0.0*	30.5
50520500	0.0	85.13	30.64	0.0	0.0*	30.5
50520700	0.0	100.00	31.38	6.51	0.0*	30.5
50530100	4.72	3.40	4.76	4.12	1.57	4.5
50530300	6.47	4.31	6.68	6.21	3.23	2.5
50530500	4.20	4.98	6.36	5.56	1.57	4.0
50550100	0.0	0.0	23.86	0.0	0.0*	83.5
50560100	0.0	0.0	0.0	0.0	0.0*	N/A
50700100	0.0	0.0	23.86	0.0	0.0*	83.5
50700300	0.0	0.0	23.86	0.0	0.0*	83.5
50710100	0.0	0.0	0.0	0.0	0.0*	N/A
51510100	20.00	20.00	30.00	0.0	20.00*	On
51510200	20.00	20.00	30.00	0.0	20.00*	On
51510300	20.00	20.00	30.00	0.0	20.00*	On
51510400	20.00	20.00	30.00	0.0	20.00*	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE

Heater ID no.[a]	Duty cycle (percent) PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	1st on time After T + 1.5 hrs
51510500	20.00	20.00	30.00	0.0	20.00*	On
51510600	20.00	20.00	30.00	0.0	20.00*	On
51510700	20.00	20.00	30.00	0.0	20.00*	On
51510800	20.00	20.00	30.00	0.0	20.00*	On
51510900	20.00	20.00	30.00	0.0	20.00*	On
51511100	20.00	20.00	30.00	0.0	20.00*	On
51511200	20.00	20.00	30.00	0.0	20.00*	On
51511300	20.00	20.00	30.00	0.0	20.00*	On
51511400	20.00	20.00	30.00	0.0	20.00*	On
51610100	20.00	20.00	30.00	0.0	20.00*	On
51610200	20.00	20.00	30.00	0.0	20.00*	On
51610300	20.00	20.00	30.00	0.0	20.00*	On
51610400	20.00	20.00	30.00	0.0	20.00*	On
51610500	20.00	20.00	30.00	0.0	20.00*	On
51610600	20.00	20.00	30.00	0.0	20.00*	On
51610700	20.00	20.00	30.00	0.0	20.00*	On
51610800	20.00	20.00	30.00	0.0	20.00*	On
51610900	20.00	20.00	30.00	0.0	20.00*	On
51611100	20.00	20.00	30.00	0.0	20.00*	On
51611200	20.00	20.00	30.00	0.0	20.00*	On
51611300	20.00	20.00	30.00	0.0	20.00*	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

TABLE B-VI.- STS-3 HEATER USAGE - Concluded

Heater ID no.[a]	Duty cycle (percent)					1st on time
	PTC or +ZLV 1.5-10.0 hrs	18 hrs +ZLV, 6 hrs PTC 10.0-34.0 hrs	+XSI (NOSE to SUN) 34.0-124.0 hrs	-ZSI (PLBAY to SUN) 124.0-150.0 hrs	PTC or +ZLV 150.0-162.0 hrs	After T + 1.5 hrs
51611400	20.00	20.00	30.00	0.0	20.00*	On

[a]TCS heaters not tabulated herein are not used in STS-3 analyses.
* Disabled for descent during deorbit prep activities.

B-VII HEATERS
STS-4 USE

TABLE B-VII.- STS-4 HEATER USAGE

Heater ID no.	Duty cycle (percent)

TBS

B-VIII HEATERS
STS-5 USE

TABLE B-VIII.- STS-5 HEATER USAGE

Heater ID no.	Duty cycle (percent)

TBS

B-IX HEATERS
STS-6 USE

TABLE B-IX.- STS-6 HEATER USAGE

Heater ID no.	Duty cycle (percent)

TBS


B-X HEATERS
1st ON TIME

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
02810100	10.5	50.0
02810200	10.5	50.0
02810300	10.5	50.0
02810400	10.5	50.0
02810500	10.5	50.0
02820100	10.5	50.0
02820200	10.5	50.0
02820300	10.5	50.0
02820400	10.5	50.0
02860300	10.5	38.0
04500000	10.0	25.0
08250100[b]	0.0	24.0
08250510[b]	0.0	24.0
08250910[b]	0.0	24.0
08510100[b]	0.0	24.0
08510110[b]	0.0	24.0
08510120[b]	0.0	24.0
08520100	5.0	5.9
08520300	5.0	5.9
08530100	5.0	5.9
08530300	5.0	5.9
08540100[b]	10.5	50.0
08540200[b]	10.5	50.0

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent	
		max	
08550000[b]	10.5	50.0	
08700100[b]	10.5	50.0	
08700200[b]	10.5	50.0	
08700300[b]	10.5	50.0	
08700400[b]	10.5	50.0	
08700500[b]	10.5	50.0	
08700600[b]	10.5	50.0	
08700700[b]	10.5	50.0	
08700800[b]	10.5	50.0	
08700900[b]	10.5	50.0	
08701100[b]	10.5	50.0	
08701200[b]	10.5	50.0	
08701300[b]	10.5	50.0	
08701400[b]	10.5	50.0	
08710100[b]	10.5	50.0	
08710200[b]	10.5	50.0	
08710300[b]	10.5	50.0	
08710400[b]	10.5	50.0	
08710500[b]	10.5	50.0	
08710600[b]	10.5	50.0	
08710700[b]	10.5	50.0	
08710800[b]	10.5	50.0	
08710900[b]	10.5	50.0	

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
08711100[b]	10.5	50.0
08711200	10.5	50.0
08711300	10.5	50.0
08711400	10.5	50.0
20510100	20.0	N/A
20510200	20.0	N/A
20510300	20.0	N/A
21510100	0.0	27.2
21510200	10.0	43.4
21510300	1.5	27.2
21510400	7.5	27.2
21510500	4.5	27.2
21510600	20.0	N/A
21510700	1.5	22.4
21510800	1.5	22.4
21510900	1.5	22.4
21511100	1.5	22.4
21511200	0.0	50.0
21511300	0.0	50.0
21530100	0.0	27.2
21530200	10.0	45.4
21530300	1.5	27.2
21530400	7.5	27.2

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
21530500	4.5	27.2
21530600	20.0	N/A
21530700	1.5	22.4
21530800	1.5	22.4
21530900	1.5	22.4
21531100	1.5	22.4
21531200	0.0	50.0
21531300	0.0	50.0
21700100	0.0	0.7
21700300	0.0	1.8
21710100	0.0	2.9
21710300	0.0	2.9
21710500	0.0	9.8
21720100	0.0	28.8
21720300	0.0	19.8
21730100	0.0	28.9
21730300	0.0	18.4
21740100	0.0	26.8
21740300	0.0	26.8
22510100	6.5	1.9
22510200	18.0	1.9
22510300	4.5	1.9
22510400	17.0	1.9

[a]TCS heaters not tabulated herein are not used in operational analyses.
[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
22510500	6.5	1.9
22510600	17.0	1.9
22510700	4.5	1.9
22510800	12.5	1.9
22510900	7.5	1.9
22511100	20.0	N/A
22511200	4.5	1.9
22511300	17.0	1.9
22511400	20.0	N/A
22511500	17.0	1.9
22520100	4.5	50.0
22520200	4.5	50.0
22520300	4.5	50.0
22520400	4.5	50.0
22520500	2.5	50.0
22520600	2.5	50.0
22520700	2.5	50.0
22520800	0.0	50.0
22520900	0.0	50.0
22521100	0.0	50.0
22521200	0.0	50.0
22521300	0.0	50.0
22530100	4.5	50.0

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
22530200	4.5	50.0
22530300	4.5	50.0
22530400	4.5	50.0
22530500	2.5	50.0
22530600	2.5	50.0
22530700	2.5	50.0
22530800	0.0	50.0
22530900	0.0	50.0
22531100	0.0	50.0
22531200	0.0	50.0
22531300	0.0	50.0
22540100	14.0	55.7
22540200	17.0	55.7
22550100	0.0	50.0
22550200	0.0	50.0
22550300	0.0	50.0
22550400	0.0	50.0
22560100	20.0	N/A
22560300	20.0	N/A
22560500	20.0	N/A
22570100	20.0	N/A
22570300	20.0	N/A
22570500	20.0	N/A

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
30530100	12.5	52.3
30540100	12.5	100
30540300	12.5	100
30540500	12.5	100
32510100	20.0	N/A
32510300	20.0	N/A
32510500	20.0	N/A
32520100	0.0	12.9
32520300	0.0	10.7
32520500	0.0	12.4
32530100	0.0	2.4
32530300	0.0	1.9
32530500	0.0	3.4
32540100	0.0	3.8
32540300	0.0	3.4
32540500	0.0	3.4
32550100	20.0	N/A
32550300	20.0	N/A
32550500	20.0	N/A
32560100	10.0	28.5
32560300	10.0	28.5
32560500	10.0	28.6
32570100	3.5	15.3

[a]TCS heaters not tabulated herein are not used in operational analyses.
[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
32570300	3.5	14.8
32570500	3.5	14.8
32580100	0.0	35.0
32580300	0.0	35.0
32580500	0.0	35.0
32590100	0.0	35.0
32590300	0.0	35.0
32590500	0.0	35.0
32600100	0.0	35.0
32610100	0.0	35.0
32620100	0.0	35.0
32630100	0.0	35.0
32630300	0.0	35.0
40600000	2.5	100
40601100	8.5	9.8
40611100	20.0	N/A
40620000	7.8	21.8
40621100	20.0	N/A
40810100	7.0	9.8
40810300	0.0	9.8
40810500	0.0	28.9
40810700	0.0	5.4
40820100	12.5	9.8

[a]TCS heaters not tabulated herein are not used in operational analyses.
[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
40820300	0.0	9.8
40820500	0.0	28.9
40820700	0.0	4.8
40900100	0.0	46.2
40910100	0.0	46.7
40920100	0.0	46.3
40930100	0.0	44.8
40940100	0.0	50.0
40950100	0.0	50.6
50040000	5.7	18.3
50510100	5.7	18.3
50510200	10.5	18.3
50510300	15.2	18.3
50520100	20.0	N/A
50520300	20.0	N/A
50520500	20.0	N/A
50520700	20.0	N/A
50530100	4.5	9.5
50530300	2.5	9.8
50530500	4.0	9.5
50550100	20.0	N/A
50560100	20.0	N/A
50700100	20.0	N/A

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION)

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent max
50700300	20.0	N/A
50710100	20.0	N/A
51510100	10.5	50.0
51510200	10.5	50.0
51510300	10.5	50.0
51510400	10.5	50.0
51510500	10.5	50.0
51510600	10.5	50.0
51510700	10.5	50.0
51510800	10.5	50.0
51510900	10.5	50.0
51511100	10.5	50.0
51511200	10.5	50.0
51511300	10.5	50.0
51511400	10.5	50.0
51610100	10.5	50.0
51610200	10.5	50.0
51610300	10.5	50.0
51610400	10.5	50.0
51610500	10.5	50.0
51610600	10.5	50.0
51610700	10.5	50.0
51610800	10.5	50.0

[a]TCS heaters not tabulated herein are not used in operational analyses.

[b]If installed.

TABLE B-X.- HEATER FIRST ON-TIME (HOURS FROM INSERTION) - Concluded

Heater ID no.[a]	First on-time (hours)	Duty Cycle (usage factor) - percent
		max
51610900	10.5	50.0
51611000	10.5	50.0
51612000	10.5	50.0
51613000	10.5	50.0
51614000	10.5	50.0

[a]TCS heaters not tabulated herein are not used in operational analyses.
[b]If installed.

B-XI HEATERS
ON-ORB MIN ENG

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
02810100		0
02810200		0
02810300		0
02810400		0
02810500		0
02820100		0
02820200		0
02820300		0
02820400		0
04500000		25.0
08250100	33	24.0
	37	24.0
08250510	32	24.0
	36	24.0
08250910	31	24.0
	35	24.0
08510100	31	24.0
	35	24.0
08510110	32	24.0
	36	24.0
08510120	33	24.0
	37	24.0
08520100		4.54

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
08520300		4.54
08530100		4.54
08530300		4.54
08540100	34	0
	35	0
	36	0
	37	0
08540200	34	0
	35	0
	36	0
	37	0
08550000	34	0
	35	0
	36	0
	37	0
08700100	34	0
	35	0
	36	0
	37	0
08700200	34	0
	35	0
	36	0
	37	0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
08700300	34	0
	35	0
	36	0
	37	0
08700400	34	0
	35	0
	36	0
	37	0
08700500	34	0
	35	0
	36	0
	37	0
08700600	34	0
	35	0
	36	0
	37	0
08700700	34	0
	35	0
	36	0
	37	0
08700800	34	0
	35	0
	36	0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	37	0
08700900	34	0
	35	0
	36	0
	37	0
08701100	34	0
	35	0
	36	0
	37	0
08701200	34	0
	35	0
	36	0
	37	0
08701300	34	0
	35	0
	36	0
	37	0
08701400	34	0
	35	0
	36	0
	37	0
08710100	34	0
	35	0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	36	0
	37	0
08710200	34	0
	35	0
	36	0
	37	0
08710300	34	0
	35	0
	36	0
	37	0
08710400	34	0
	35	0
	36	0
	37	0
08710500	34	0
	35	0
	36	0
	37	0
08710600	34	0
	35	0
	36	0
	37	0
08710700	34	0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	35	0
	36	0
	37	0
08710800	34	0
	35	0
	36	0
	37	0
08710900	34	0
	35	0
	36	0
	37	0
08711100	34	0
	35	0
	36	0
	37	0
08711200	34	0
	35	0
	36	0
	37	0
08711300	34	0
	35	0
	36	0
	37	0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
08711400	34	0
	35	0
	36	0
	37	0
20510100		0.67
20510200		0.30
20510300		0.27
21510100[b]		8.64
21510200[b]		14.4
21510300[b]		8.63
21510400[b]		8.63
21510500[b]		8.63
21510600[b]		33.33
21510700[b]		7.12
21510800[b]		7.12
21510900[b]		7.12
21511100[b]		7.12
21511200[b]		0
21511300[b]		0
21530100[b]		8.64
21530200[b]		14.4
21530300[b]		8.63
21530400[b]		8.63

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
21530500[b]		8.63
21530600[b]		33.33
21530700[b]		7.12
21530800[b]		7.12
21530900[b]		7.12
21531100[b]		7.12
21531200[b]		0
21531300[b]		0
21700100		0
21700300		1.71
21710100		2.78
21710300		2.78
21710500		9.26
21720100		13.50
21720300		8.39
21730100		13.72
21730300		7.73
21740100		10.29
21740300		10.19
22510100		1.10
22510200		1.10
22510300		1.10
22510400		1.10

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
22510500		1.10
22510600		1.10
22510700		1.10
22510800		1.10
22510900		1.10
22511100		1.10
22511200		1.10
22511300		1.10
22511400		1.10
22511500		1.10
22520100		50.0
22520200		50.0
22520300		50.0
22520400		50.0
22520500		50.0
22520600		50.0
22520700		50.0
22520800		50.0
22520900		50.0
22521100		50.0
22521200		50.0
22521300		50.0
22530100		50.0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
22530200		50.0
22530300		50.0
22530400		50.0
22530500		50.0
22530600		50.0
22530700		50.0
22530800		50.0
22530900		50.0
22531100		50.0
22531200		50.0
22531300		50.0
22540100		30.86
22540200		30.86
22550100		50.0
22550200		50.0
22550300		50.0
22550400		50.0
22560100[b]		0
22560300[b]		0
22560500[b]		0
22570100[b]		0
22570300[b]		0
22570500[b]		0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
30530100		8.80
30540100		0
30540300		76.41
30540500		38.21
32510100		4.66
32510300		4.70
32510500		4.85
32520100		10.34
32520300		8.56
32520500		10.05
32530100		2.25
32530300		1.82
32530500		3.31
32540100		3.53
32540300		3.17
32540500		3.27
32550100		12.68
32550300		12.68
32550500		12.79
32560100		26.81
32560300		26.31
32560500		27.61
32570100		13.69

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
32570300		13.24
32570500		13.24
32580100		30.00
32580300		30.00
32580500		30.00
32590100		30.00
32590300		30.00
32590500		30.00
32600100		30.00
32610100		30.00
32620100		30.00
32630100		30.00
32630300		30.00
40601100[b]		1.53
40611100[b]		9.11
40620000[b]		2.97
40621100[b]		1.45
40810100		1.06
40810300		1.06
40810500		0.69
40810700		3.74
40820100		1.04
40820300		1.04

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
40820500		3.94
40820700		3.07
40900100		29.13
40910100		29.42
40920100		28.62
40930100		27.76
40940100		30.97
40950100		32.30
50040000		8.35
50510100		8.35
50510200		8.35
50510300		8.35
50520100		0
50520300		0
50520500		0
50520700		0
50530100		11.06
50530300		11.37
50530500		11.06
50550100[b]		0
50560100[b]		2.36
50700100[b]		0
50700300[b]		0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
50710100[b]		0
51510100		0
51510200		0
51510300		0
51510400		0
51510500		0
51510600		0
51510700		0
51510800		0
51510900		0
51511100		0
51511200		0
51511300		0
51511400		0
51610100		0
51610200		0
51610300		0
51610400		0
51610500		0
51610600		0
51610700		0
51610800		0
51610900		0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XI.- ON-ORBIT HEATER USAGE - MINIMUM ENERGY - Concluded

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
51611100		0
51611200		0
51611300		0
51611400		0

[a]TCS heaters not tabulated herein are not used in minimum energy analyses.

[b]Heater disabled during deorbit prep activities.

B-XII HEATERS
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TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
02810100		25.00
02810200		25.00
02810300		25.00
02810400		25.00
02810500		25.00
02820100		25.00
02820200		25.00
02820300		25.00
02820400		25.00
02860300		19.0
04500000		50.0
08250100	33	24.0
	37	24.0
08250510	32	24.0
	36	24.0
08250910	31	24.0
	35	24.0
08510100	31	24.0
	35	24.0
08510110	32	24.0
	36	24.0
08510120	33	24.0
	37	24.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
08520100		5.26
08520300		5.26
08530100		5.26
08530300		5.26
08540100	34	25.0
	35	25.0
	36	25.0
	37	25.0
08540200	34	25.0
	35	25.0
	36	25.0
	37	25.0
08550000	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700100	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700200	34	25.0
	35	25.0
	36	25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	37	25.0
08700300	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700400	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700500	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700600	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700700	34	25.0
	35	25.0
	36	25.0
	37	25.0
08700800	34	25.0
	35	25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	36	25.0
	37	25.0
08700900	34	25.0
	35	25.0
	36	25.0
	37	25.0
08701100	34	25.0
	35	25.0
	36	25.0
	37	25.0
08701200	34	25.0
	35	25.0
	36	25.0
	37	25.0
08701300	34	25.0
	35	25.0
	36	25.0
	37	25.0
08701400	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710100	34	25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	35	25.0
	36	25.0
	37	25.0
08710200	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710300	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710400	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710500	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710600	34	25.0
	35	25.0
	36	25.0
	37	25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
08710700	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710800	34	25.0
	35	25.0
	36	25.0
	37	25.0
08710900	34	25.0
	35	25.0
	36	25.0
	37	25.0
08711100	34	25.0
	35	25.0
	36	25.0
	37	25.0
08711200	34	25.0
	35	25.0
	36	25.0
	37	25.0
08711300	34	25.0
	35	25.0
	36	25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
	37	25.0
08711400	34	25.0
	35	25.0
	36	25.0
	37	25.0
20510100		1.44
20510200		1.03
20510300		1.04
21510100[b]		17.93
21510200[b]		29.88
21510300[b]		17.91
21510400[b]		17.91
21510500[b]		17.91
21510600[b]		69.17
21510700[b]		14.78
21510800[b]		14.78
21510900[b]		14.78
21511100[b]		14.78
21511200[b]		25.0
21511300[b]		25.0
21530100[b]		17.93
21530200[b]		29.88
21530300[b]		17.91

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
21530400[b]		17.91
21530500[b]		17.91
21530600[b]		69.17
21530700[b]		14.78
21530800[b]		14.78
21530900[b]		14.78
21531100[b]		14.78
21531200[b]		25.0
21531300[b]		25.0
21700100		0.91
21700300		1.77
21710100		2.86
21710300		2.86
21710500		9.54
21720100		21.14
21720300		14.12
21730100		21.33
21730300		13.08
21740100		18.52
21740300		18.47
22510100		1.54
22510200		1.54
22510300		1.54

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
22510400		1.54
22510500		1.54
22510600		1.54
22510700		1.54
22510800		1.54
22510900		1.54
22511100		1.54
22511200		1.54
22511300		1.54
22511400		1.54
22511500		1.54
22520100		50.0
22520200		50.0
22520400		50.0
22520500		50.0
22520600		50.0
22520700		50.0
22520800		50.0
22520900		50.0
22521100		50.0
22521200		50.0
22521300		50.0
22530100		50.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
22530200		50.0
22530300		50.0
22530400		50.0
22530500		50.0
22530600		50.0
22530700		50.0
22530800		50.0
22530900		50.0
22531100		50.0
22531200		50.0
22531300		50.0
22540100		43.26
22540200		43.26
22550100		50.0
22550200		50.0
22550300		50.0
22550400		50.0
22560100[b]		10.68
22560300[b]		10.68
22560500[b]		10.68
22570100[b]		10.68
22570300[b]		10.68
22570500[b]		10.68

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
30530100		29.66
30540100		0
30540300		88.21
30540500		69.11
32510100		5.12
32510300		5.14
32510500		5.38
32520100		11.59
32520300		9.69
32520500		11.20
32530100		2.35
32530300		1.91
32530500		3.39
32540100		3.68
32540300		3.30
32540500		3.32
32550100		13.07
32550300		13.07
32550500		13.27
32560100		27.63
32560300		27.63
32560500		27.83
32570100		14.49

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
32570300		14.02
32570500		14.02
32580100		50.0
32580300		50.0
32580500		50.0
32590100		50.0
32590300		50.0
32590500		50.0
32600100		50.0
32610100		50.0
32620100		50.0
32630100		50.0
32630300		50.0
40601100[b]		5.69
40611100[b]		35.39
40620000[b]		12.40
40621100[b]		6.06
40810100		5.41
40810300		5.41
40810500		14.79
40810700		4.58
40820100		5.43
40820300		5.43

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
40820500		16.46
40820700		3.93
40900100		37.65
40910100		38.04
40920100		37.44
40930100		36.29
40940100		40.49
40950100		41.46
50040000		13.31
50510100		13.31
50510200		13.31
50510300		13.31
50520100		4.29
50520300		5.69
50520500		4.34
50520700		5.71
50530100		12.53
50530300		12.88
50530500		12.53
50550100[b]		0
50560100[b]		16.57
50700100[b]		17.03
50700300[b]		16.54

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
50710100[b]		26.70
51510100		25.0
51510200		25.0
51510300		25.0
51510400		25.0
51510500		25.0
51510600		25.0
51510700		25.0
51510800		25.0
51510900		25.0
51511100		25.0
51511200		25.0
51511300		25.0
51511400		25.0
51610100		25.0
51610200		25.0
51610300		25.0
51610400		25.0
51610500		25.0
51610600		25.0
51610700		25.0
51610800		25.0
51610900		25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XII.- ON-ORBIT HEATER USAGE - NOMINAL ENERGY - Concluded

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 40
51611100		25.0
51611200		25.0
51611300		25.0
51611400		25.0

[a]TCS heaters not tabulated, herein, are not used in nominal energy analyses.

[b]Heater disabled during deorbit prep activities.

B-XIII HEATERS
ON-ORB MAX ENG

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
02810100		50.00
02810200		50.00
02810300		50.00
02810400		50.00
02810500		50.00
02820100		50.00
02820200		50.00
02820300		50.00
02820400		50.00
02860300		38.00
04500000		75.00
08250100	33	24.00
	37	24.00
08250510	32	24.00
	36	24.00
08250910	31	24.00
	35	24.00
08510100	31	24.00
	35	24.00
08510110	32	24.00
	36	24.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
08510120	33	24.00
	37	24.00
08520100		5.98
08520300		5.98
08530100		5.98
08530300		5.98
08540100	34	50.00
	35	50.00
	36	50.00
	37	50.00
08540200	34	50.00
	35	50.00
	36	50.00
	37	50.00
08550000	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700100	34	50.00
	35	50.00
	36	50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
	37	50.00
08700200	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700300	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700400	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700500	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700600	34	50.00
	35	50.00
	36	50.00
	37	50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
08700700	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700800	34	50.00
	35	50.00
	36	50.00
	37	50.00
08700900	34	50.00
	35	50.00
	36	50.00
	37	50.00
08701100	34	50.00
	35	50.00
	36	50.00
	37	50.00
08701200	34	50.00
	35	50.00
	36	50.00
	37	50.00
08701300	34	50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
	35	50.00
	36	50.00
	37	50.00
08701400	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710100	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710200	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710300	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710400	34	50.00
	35	50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

bHeater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
	36	50.00
	37	50.00
08710500	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710600	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710700	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710800	34	50.00
	35	50.00
	36	50.00
	37	50.00
08710900	34	50.00
	35	50.00
	36	50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
	37	50.00
08711100	34	50.00
	35	50.00
	36	50.00
	37	50.00
08711200	34	50.00
	35	50.00
	36	50.00
	37	50.00
08711300	34	50.00
	35	50.00
	36	50.00
	37	50.00
08711400	34	50.00
	35	50.00
	36	50.00
	37	50.00
20510100		2.17
20510200		1.74
20510300		1.78
21510100[b]		27.21

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent - BETA = 00 - 90
21510200[b]		45.35
21510300[b]		27.18
21510400[b]		27.18
21510500[b]		27.18
21510600[b]		100
21510700[b]		22.43
21510800[b]		22.43
21510900[b]		22.43
21511100[b]		22.43
21511200[b]		50.00
21511300[b]		50.00
21530100[b]		27.21
21530200[b]		45.35
21530300[b]		27.18
21530400[b]		27.18
21530500[b]		27.18
21530600[b]		100
21530700[b]		22.43
21530800[b]		22.43
21530900[b]		22.43
21531100[b]		22.43

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
21531200[b]		50.00
21531300[b]		50.00
21700100		1.81
21700300		1.81
21710100		2.95
21710300		2.95
21710500		9.82
21720100		28.77
21720300		19.84
21730100		28.93
21730300		18.44
21740100		26.75
21740300		26.75
22510100		1.98
22510200		1.98
22510300		1.98
22510400		1.98
22510500		1.98
22510600		1.98
22510700		1.98
22510800		1.98

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
22510900		1.98
22511100		1.98
22511200		1.98
22511300		1.98
22511400		1.98
22511500		1.98
22520100		50.00
22520200		50.00
22520300		50.00
22520400		50.00
22520500		50.00
22520600		50.00
22520700		50.00
22520800		50.00
22520900		50.00
22521100		50.00
22521200		50.00
22521300		50.00
22530100		50.00
22530200		50.00
22530300		50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
22530400		50.00
22530500		50.00
22530600		50.00
22530700		50.00
22530800		50.00
22530900		50.00
22531100		50.00
22531200		50.00
22531300		50.00
22540100		55.65
22540200		55.65
22550100		50.00
22550200		50.00
22550300		50.00
22550400		50.00
22560100[b]		21.36
22560300[b]		21.36
22560500[b]		21.36
22570100[b]		21.36
22570300[b]		21.36
22570500[b]		21.36

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
30530100		50.52
30540100		0
30540300		100
30540500		100
32510100		5.57
32510300		5.57
32510500		5.90
32520100		12.85
32520300		10.74
32520500		12.36
32530100		2.43
32530300		1.99
32530500		3.46
32540100		3.82
32540300		3.43
32540500		3.36
32550100		13.46
32550300		13.46
32550500		13.75
32560100		28.45
32560300		28.45

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
32560500		28.62
32570100		15.28
32570300		14.79
32570500		14.79
32580100		75
32580300		75
32580500		75
32590100		75
32590300		75
32590500		75
32600100		75
32610100		75
32620100		75
32630100		75
32630300		75
40601100[b]		9.84
40611100[b]		61.67
40620000[b]		21.83
40621100[b]		10.67
40810100		9.75
40810300		9.75

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
40810500		28.87
40810700		5.42
40820100		9.82
40820300		9.82
40820500		28.96
40820700		4.79
40900100		50.00
40910100		50.00
40920100		50.00
40930100		50.00
40940100		50.00
40950100		50.00
50040000		18.26
50510100		18.26
50510200		18.26
50510300		18.26
50520100		8.59
50520300		11.36
50520500		8.68
50520700		11.42
50530100		14.01

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
50530300		14.40
50530500		14.01
50550100[b]		0
50560100[b]		30.77
50700100[b]		34.06
50700300[b]		33.08
50710100[b]		53.40
51510100		50.00
51510200		50.00
51510300		50.00
51510400		50.00
51510500		50.00
51510600		50.00
51510700		50.00
51510800		50.00
51510900		50.00
51511100		50.00
51511200		50.00
51511300		50.00
51511400		50.00
51610100		50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.

[b]Heater disabled during deorbit prep activities.

TABLE B-XIII.- ON-ORBIT HEATER USAGE - MAXIMUM ENERGY - Concluded

Heater ID no.[a]	Effectivity	Duty cycle (usage factor) - percent BETA = 00 - 90
51610200		50.00
51610300		50.00
51610400		50.00
51610500		50.00
51610600		50.00
51610700		50.00
51610800		50.00
51610900		50.00
51611100		50.00
51611200		50.00
51611300		50.00
51611400		50.00

[a]TCS heaters not tabulated herein are not used in maximum energy analyses.
[b]Heater disabled during deorbit prep activities.

B-XIV STS-1
CRYO HTR

TABLE B-XIV.- STS-1 CRYO HEATER AND CONTROLLER DUTY CYCLES

Heater ID no.[a]	Description	Duty cycle percent	Remarks[b]
31170100	O2 TANK1 HTR A1	100	Start of A htr enable to start A + 1:01:00
		64.0	Start A + 1:01:00 to start A + 03:21:00
		24.0	Start of B htr enable to start B + 04:31:00
		21.5	Start B + 04:31:00 to start B + 09:31:00
		17.0	Start B + 09:31:00 to start B + 19:37:00
		18.5	Start B + 19:37:00 to start B + 26:25:00
		13.0	Start B + 26:25:00 to start B + 33:43:00
		9.5	Start B + 33:43:00 to start B + 42:25:00
		20.0	Start B + 42:25:00 to E.O.M.
31170200	O2 TANK1 HTR A2		Same as 31170100
31170300	O2 TANK2 HTR A1		Same as 31170100
31170400	O2 TANK2 HTR A2		Same as 31170100
31180100	O2 TANK1 HTR B1	24.0	Start of B htr enable to start B + 04:31:00
		21.5	Start B + 04:31:00 to start B + 09:31:00
		17.0	Start B + 09:31:00 to start B + 19:37:00
		18.5	Start B + 19:37:00 to start B + 26:25:00
		13.0	Start B + 26:25:00 to start B + 33:43:00
		9.5	Start B + 33:43:00 to start B + 42:25:00
		0	Start B + 42:25:00 to E.O.M.
31180200	O2 TANK1 HTR B2		Same as 31180100
31180300	O2 TANK2 HTR B1		Same as 31180100
31180400	O2 TANK2 HTR B2		Same as 31180100
31190100	H2 TANK1 HTR A	100	Start of A htr enable to start A + 01:01:00
		58.0	Start A + 01:01:00 to start A + 03:21:00
		20.0	Start of B htr enable to start B + 04:31:00
		19.0	Start B + 04:31:00 to start B + 09:31:00
		16.0	Start B + 09:31:00 to start B + 19:37:00
		17.0	Start B + 19:37:00 to start B + 26:25:00
		12.5	Start B + 26:25:00 to start B + 33:43:00
		10.0	Start B + 33:43:00 to start B + 42:25:00
		11.5	Start B + 42:25:00 to E.O.M.

[a]Cryo heaters and controllers not tabulated herein are not utilized in the analysis of STS-1.
[b]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00.

TABLE B-XIV.- Concluded

Heater ID no.[a]	Description	Duty cycle percent	Remarks[b]
31190200	H2 TANK1 HTR B	20.0	Start of B htr enable to start B + 04:31:00
		19.0	Start B + 04:31:00 to start B + 09:31:00
		16.0	Start B + 09:31:00 to Start B + 19:37:00
		17.0	Start B + 19:37:00 to start B + 26:25:00
		12.5	Start B + 26:25:00 to start B + 33:43:00
		10.0	Start B + 33:43:00 to start B + 42:25:00
		0	Start B + 42:25:00 to E.O.M.
31190300	H2 TANK2 HTR A		Same as 31190100
31190400	H2 TANK2 HTR B		Same as 31190200
06180300	H2O2 CRYO ASY1A-H2CY		Same as 31190100
06180400	H2O2 CRYO ASY1B-H2CY		Same as 31190200
06180500	H2O2 CRYO ASY1A-O2CY		Same as 31170100
06180600	H2O2 CRYO ASY1B-O2CY		Same as 31180100
06181300	H2O2 CRYO ASY2A-H2CY		Same as 31190100
06181400	H2O2 CRYO ASY2B-H2CY		Same as 31190200
06181500	H2O2 CRYO ASY2A-O2CY		Same as 31170100
06181600	H2O2 CRYO ASY2B-O2CY		Same as 31180100

[a]Cryo heaters and controllers not tabulated herein are not utilized in the analysis of STS-1.
[b]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00.

B-XV STS-2
CRYO HTR

TABLE B-XV.- STS-2 CRYO HEATER AND CONTROLLER DUTY CYCLES

Heater ID no.[a]	Description	Duty cycle percent	Remarks[b]
31170100	O2 TANK1 HTR A1	100	Start of A htr enable to start A + 01:01:00
		64.0	Start of A + 01:01:00 to start A + 03:21:00
		26.9	Start of B htr enable to start B + 33:00:00
		13.0	Start B + 33:00:00 to start B + 66:00:00
		15.8	Start B + 66:00:00 to start B + 106:00:00
		31.0	Start B + 106:00:00 to start B + 119:00:00
		0	Start B + 119:00:00 to E.O.M.
31170200	O2 TANK1 HTR A2		Same as 31170100
31170300	O2 TANK2 HTR A1		Same as 31170100
31170400	O2 TANK2 HTR A2		Same as 31170100
31170500	O2 TANK3 HTR A1	100	Start of A htr enable to start A + 01:01:00
		64.0	Start A + 01:01:00 to start A + 03:21:00
		54.3	Start of B htr enable to start B + 16:30:00
		26.0	Start of B + 16:30:00 to start B + 33:00:00
		32.5	Start B + 33:00:00 to start B + 52:45:00
		63.0	Start B + 52:45:00 to start B + 59:15:00
		0	Start B + 59:15:00 to E.O.M.
31170600	O2 TANK3 HTR A2		Same as 31170500
31180100	O2 TANK1 HTR B1	26.9	Start of B htr enable to start B + 33:00:00
		13.0	Start B + 33:00:00 to start B + 66:00:00
		0	Start B + 66:00:00 to E.O.M.
31180200	O2 TANK1 HTR B2		Same as 31180100
31180300	O2 TANK2 HTR B1		Same as 31180100
31180400	O2 TANK2 HTR B2		Same as 31180100
31180500	O2 TANK3 HTR B1	54.3	Start of B htr to start B + 16:30:00
		26.0	Start B + 16:30:00 to start B + 33:00:00
		0	Start B + 33:00:00 to E.O.M.
31180600	O2 TANK3 HTR B2		Same as 31180500

[a]Cryo heaters and controllers not tabulated herein are not utilized in the analysis of STS-2.
[b]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00.

TABLE B-XV.- Continued

Heater ID no.[a]	Description	Duty cycle percent	Remarks[b]
31190100	H2 TANK1 HTR A	100	Start of A htr enable to start A + 01:01:00
		58.0	Start A + 01:01:01 to start A + 03:21:00
		26.5	Start of B htr enable to start B + 31:30:00
		16.0	Start B + 31:30:00 to start B + 63:00:00
		28.0	Start B + 63:00:00 to start B + 100:00:00
		55.0	Start B + 100:00:00 to start B + 113:00:00
		0	Start B + 113:00:00 to E.O.M.
31190200	H2 TANK1 HTR B	26.5	Start of B htr enable to start B + 31:30:00
		16.0	Start B + 31:30:00 to start B + 63:00:00
		0	Start B + 63:00:00 to E.O.M.
31190300	H2 TANK2 HTR A		Same as 31190100
31190400	H2 TANK2 HTR B		Same as 31190200
31190500	H2 TANK3 HTR A	100	Start of A htr enable to start A + 01:01:00
		58.0	Start A + 01:01:00 to start A + 03:21:00
		53.0	Start of B htr enable to start B + 15:45:00
		32.1	Start B + 15:45:00 to start B + 31:30:00
		57.0	Start B + 31:30:00 to start B + 50:15:00
		87.0	Start B + 50:15:00 to start B + 56:30:00
		0	Start B + 56:30:00 to E.O.M.
31190600	H2 TANK3 HTR B	53.00	Start of B htr enable to start B + 15:45:00
		32.1	Start B + 15:45:00 to start B + 31:30:00
		0	Start B + 31:30:00 to E.O.M.
06180300	H2O2 CRYO ASY1A-H2CY		Same as 31190100
06180400	H2O2 CRYO ASY1B-H2CY		Same as 31190200
06180500	H2O2 CRYO ASY1A-O2CY		Same as 31170100
06180600	H2O2 CRYO ASY1B-O2CY		Same as 31180100
06181300	H2O2 CRYO ASY2A-H2CY		Same as 31190100
06181400	H2O2 CRYO ASY2B-H2CY		Same as 31190200
06181500	H2O2 CRYO ASY2A-O2CY		Same as 31170100

[a]Cryo heaters and controllers not tabulated herein are not utilized in the analysis of STS-2.
[b]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00.

TABLE B-XV.- Concludec

Heater ID no.[a]	Description	Duty cycle percent	Remarks[b]
06181600	H2O2 CRYO ASY2B-O2CY		Same as 31180100
06182300	H2O2 CRYO ASY3A-H2CY		Same as 31190500
06182400	H2O2 CRYO ASY3B-H2CY		Same as 31190600
06182500	H2O2 CRYO ASY3A-O2CY		Same as 31170500
06182600	H2O2 CRYO ASY3B-O2CY		Same as 31180500

[a]Cryo heaters and controllers not tabulated herein are not utilized in the analysis of STS-2.
[b]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00.

B-XVI OPS
CRYO HTR

TABLE B-XVI.- OPS CRYO HEATER AND CONTROLLER DUTY CYCLES

Heater ID no.	Description	Duty cycle percent	Remarks[a]
31170100	O2 TANK1 HTR A1	100	Start of A htr enable to start A + 01:01:00
		64.0	Start A + 01:01:00 to start A + 03:21:00
		26.9	Start of B htr enable to start B + 33:00:00
		13.0	Start B + 33:00:00 to start B + 66:00:00
		15.8	Start B + 66:00:00 to start B + 106:00:00
		31.0	Start B + 106:00:00 to start B + 119:00:00
		0	Start B + 119:00:00 to E.O.M.
31170200	O2 TANK1 HTR A2		Same as 31170100
31170300	O2 TANK2 HTR A1		Same as 31170100
31170400	O2 TANK2 HTR A2		Same as 31170100
31170500	O2 TANK3 HTR A1		Same as 31170100
31170600	O2 TANK3 HTR A2		Same as 31170100
08650100	O2 TANK4 HTR A1		Same as 31170100
08650200	O2 TANK4 HTR A2		Same as 31170100
31180100	O2 TANK1 HTR B1	26.9	Start of B htr enable to start B + 33:00:00
		13.0	Start B + 33:00:00 to start B + 66:00:00
		0	Start B + 66:00:00 to E.O.M.
31180200	O2 TANK1 HTR B2		Same as 31180100
31180300	O2 TANK2 HTR B1		Same as 31180100
31180400	O2 TANK2 HTR B2		Same as 31180100
31180500	O2 TANK3 HTR B1		Same as 31180100
31180600	O2 TANK3 HTR B2		Same as 31180100
08650300	O2 TANK4 HTR B1		Same as 31180100
08650400	O2 TANK4 HTR B2		Same as 31180100

[a]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00

TABLE B-XVI.- Continued

Heater ID no.	Description	Duty cycle percent	Remarks[a]
31190100	H2 TANK1 HTR A	100	Start of A htr enable to start A + 01:01:00
		56.0	Start A + 01:01:00 to start A + 03:21:00
		26.5	Start of B htr enable to start B + 31:30:00
		16.0	Start B + 31:30:00 to start B + 63:00:00
		28.0	Start B + 63:00:00 to start B + 100:00:00
		55.0	Start B + 100:00:00 to start B + 113:00:00
		0	Start B + 113:00:00 to E.O.M.
31190200	H2 TANK1 HTR B	26.5	Start of B htr enable to start B + 31:30:00
		16.0	Start B + 31:30:00 to start B + 63:00:00
		0	Start B + 63:00:00 to E.O.M.
31190300	H2 TANK2 HTR A		Same as 31190100
31190400	H2 TANK2 HTR B		Same as 31190200
31190500	H2 TANK3 HTR A		Same as 31190100
31190600	H2 TANK3 HTR B		Same as 31190200
08660100	H2 TANK4 HTR A		Same as 31190100
08660200	H2 TANK4 HTR B		Same as 31190200
06180300	H2O2 CRYO ASY1A-H2CY		Same as 31190100
06180400	H2O2 CRYO ASY1B-H2CY		Same as 31190200
06180500	H2O2 CRYO ASY1A-O2CY		Same as 31170100
06180600	H2O2 CRYO ASY1B-O2CY		Same as 31180100
06181300	H2O2 CRYO ASY2A-H2CY		Same as 31190100
06181400	H2O2 CRYO ASY2B-H2CY		Same as 31190200
06181500	H2O2 CRYO ASY2A-O2CY		Same as 31170100
06181600	H2O2 CRYO ASY2B-O2CY		Same as 31180100
06182300	H2O2 CRYO ASY3A-H2CY		Same as 31190100

[a]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00

TABLE B-XVI.- Concluded

Heater ID no.	Description	Duty cycle percent	Remarks[a]
06182400	H2O2 CRYO ASY3B-H2CY		Same as 31190200
06182500	H2O2 CRYO ASY3A-O2CY		Same as 31170100
06182600	H2O2 CRYO ASY3B-O2CY		Same as 31180100
08460300	H2O2 CRYO ASY4A-H2CY		Same as 31190100
08460400	H2O2 CRYO ASY4B-H2CY		Same as 31190200
08460500	H2O2 CRYO ASY4A-O2CY		Same as 31170100
08460600	H2O2 CRYO ASY4B-O2CY		Same as 31180100

[a]Heater A enable time: MECO + 5 min. Heater B enable time: MECO + 03:26:00

* U.S. GOVERNMENT PRINTING OFFICE: 1980—671-099/2002